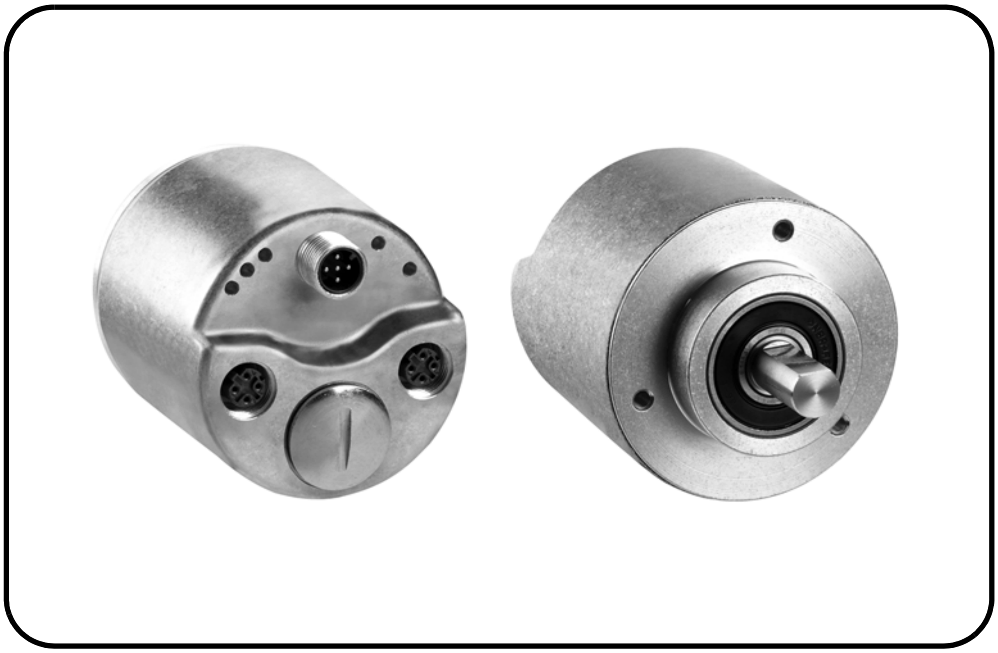
User Manual

Allen-Bradley

842E EtherNet/IP™ Absolute Encoder
842E-SIP-xxx, 842E-MIP-xxx



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Important User Information

Because of the variety of uses for the products described in this publication, those responsible for the application and use of this control equipment must satisfy themselves that all necessary steps have been taken to assure that each application and use meets all performance and safety requirements, including any applicable laws, regulations, codes and standards.

The illustrations, charts, sample programs and layout examples shown in the guide are intended solely for purposes of example. Since there are many variables and requirements associated with any particular installation, Rockwell Automation does not assume responsibility or liability (to include intellectual property liability) for actual use based upon the examples shown in this publication.

Rockwell Automation publication SGI-1.1, Safety Guidelines for the Application, Installation and Maintenance of Solid-State Control (available from your local Rockwell Automation sales office), describes some important differences between solid-state equipment and electromechanical devices that should be taken into consideration when applying products such as those described in this publication.

Throughout this manual we use notes to make you aware of safety considerations:

WARNING	Identifies information about practices or circumstances that can cause an explosion in a hazardous environment, which may lead to personal injury or death, property damage, or economic loss.
IMPORTANT	Identifies information that is critical for successful application and understanding of the product.
ATTENTION	Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss. Attentions help you identify a hazard, avoid a hazard, and recognize the consequences.
SHOCK HAZARD	Labels may be on or inside the equipment (for example, drive or motor) to alert people that dangerous voltage may be present.
BURN HAZARD	Labels may be on or inside the equipment (for example, drive or motor) to alert people that surfaces may reach dangerous temperatures.

It is recommended that you save this user manual for future use.

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Read this section to familiarize yourself with the rest of the manual. It provides information concerning:

- Who should use this manual
- The purpose of this manual
- Related documentation
- Conventions used in this manual

Who should use this manual

Use this manual if you are responsible for designing, installing, programming, or troubleshooting control systems that use 842E EtherNet/IP™ encoder.

You should have a basic understanding of electrical circuitry and familiarity with relay logic. If you do not, obtain the proper training before using this product.

Purpose of this manual

This manual is a reference guide for the 842E EtherNet/IP encoders. It describes the procedures you use to install, wire, and troubleshoot your encoder. This manual:

- Gives you an overview of the 842E EtherNet/IP encoders
- Explains how to install and wire your encoder

Related documentation

The following documents contain additional information concerning Rockwell Automation products. To obtain a copy, contact your local Rockwell Automation office or Allen-Bradley® distributor.

Resource	Description
Installation Instructions 842E EtherNet/IP Multi-turn Encoders	Pub. # 10000169360
EtherNet/IP Modules in Logix5000 Control Systems User Manual, publication ENET-UM001	A manual on how to use EtherNet/IP modules with Logix5000 controllers and communicate with various devices on the ethernet network
Getting Results with RSLogix™ 5000, publication 9399-RLD300GR	Information on how to install and navigate RSLogix 5000. The guide includes troubleshooting information and tips on how to use RSLogix 5000 effectively.
M116 On-Machine Connectivity Catalog, M116-CA001A	An article on wire sizes and types for grounding electrical equipment
Allen-Bradley Industrial Automation Glossary, AG-7.1	A glossary of industrial automation terms and abbreviations

Common techniques used in this manual

The following conventions are used throughout this manual:

- Bulleted lists such as this one provide information, not procedural steps.
- Numbered lists provide sequential steps or hierarchical information.
- *Italic* type is used for emphasis.

Notes:

Safety

This chapter deals with your own safety and the safety of the equipment operators.

Please read this chapter carefully before working with the 842E EtherNet/IP encoder or the machine or system in which the 842E EtherNet/IP encoder is used.

Authorized personnel

ATTENTION

The 842E EtherNet/IP encoder must only be installed, commissioned, and serviced by authorized personnel.

Repairs to the 842E EtherNet/IP encoder are only allowed to be undertaken by trained and authorized service personnel from Rockwell Automation.

The following qualifications are necessary for the various tasks:

Activity	Qualification
Mounting	Basic technical training Knowledge of the current safety regulations in the workplace
Electrical installation and replacement	Practical electrical training Knowledge of current electrical safety regulations Knowledge on the use and operation of devices in the related application (e.g., industrial robots, storage, and conveyor technology)
Commissioning, operation, and configuration	Knowledge on the current safety regulations and the use and operation of devices in the related application Knowledge of automation systems (e.g. Rockwell ControlLogix controller) Knowledge of EtherNet/IP Knowledge of the usage of automation software (e.g. Rockwell RSLogix)

Correct use

The 842E EtherNet/IP Absolute Encoder is an instrument that is manufactured in accordance with recognized industrial regulations and meets the quality requirements as per ISO 9001:2008 as well as those of an environment management system as per ISO 14_001:2009.

An encoder is a device for mounting that cannot be used independently of its foreseen function. For this reason an encoder is not equipped with immediate safety devices. Considerations for the safety of personnel and systems must be provided by the operator of the system as per statutory regulations. Due to its design, the 842E EtherNet/IP can only be operated within an EtherNet/IP network. It is necessary to comply with the EtherNet/IP specifications and guidelines for setting up an EtherNet/IP network. In case of any other usage or modifications to the 842E EtherNet/IP, e.g., opening the housing during mounting and electrical installation, or in case of modifications to the software, any claims against Rockwell Automation under warranty will be rendered void.

General safety notes and protective measures

ATTENTION

Please observe the following procedures in order to ensure the correct and safe use of the 842E EtherNet/IP encoder.

The encoder is to be installed and maintained by trained and qualified personnel with knowledge of electronics, precision mechanics and control system programming. It is necessary to comply with the related standards covering the technical safety stipulations.

All safety regulations are to be met by all persons who are installing, operating or maintaining the device:

- The operating instructions must always be available and must always be followed.
- Unqualified personnel are not allowed to be present in the vicinity of the system during installation.
- The system is to be installed in accordance with all applicable safety regulations and the mounting instructions.
- All work safety regulations of the applicable countries are to be followed during installation.
- Failure to follow all applicable health and safety regulations may result in personal injury or damage to the system.
- The current and voltage sources in the encoder are designed in accordance with all applicable technical regulations.

Environmental protection

Please note the following information on disposal.

Assembly	Material	Disposal
Packaging	Cardboard	Waste paper
Shaft	Stainless steel	Scrap metal
Flange	Aluminum	Scrap metal
Housing	Aluminum Die-cast	Scrap metal
Electronic assemblies	Various	Hazardous waste

Encoder overview

The 842E family of encoders uses EtherNet/IP technology to provide its data to a programmable controller. These encoders include an embedded EtherNet/IP switch to connect additional EtherNet/IP capable products in series and/or support a device level ring (DLR) topology for ethernet media redundancy.

The 842E are ultra-high resolution encoders in single-turn and multi-turn versions. These encoders have 18 bit single-turn resolution. The multi-turn has an additional 12 bits for counting the number of revolutions.

Overview of the encoder

What is an encoder?

Encoders can electronically monitor the position of a rotating shaft to measure information such as speed, distance, RPM, and position. Rockwell Automation offers a variety of light- and heavy-duty incremental and absolute encoders. Our accessories help you easily install and efficiently use our encoders.

What are the different kinds of encoders?

Incremental

A simple and cost-effective solution for a wide variety of applications, incremental encoders electronically monitor the position or speed of a rotating shaft. Encoder feedback is compatible with programmable controllers, numerical controllers, motion controllers, and other positioning systems. Rockwell Automation offers light-duty and heavy-duty incremental encoders for differing shaft loads. Ruggedized incremental encoders are available with an enclosure rating of NEMA Type 4 and IP66. Incremental encoders are also available in solid and hollow shaft models for a variety of mounting options. Applications include: machine tools, packaging machinery, motion controls, robotics, and DC drives.

Absolute

An absolute encoder has a unique digital output for each shaft position. The use of absolute encoders assures that true position is always available, regardless of power interruptions to the system. Absolute encoders can be single-turn or multi-turn.

Multi-turn units assign a unique digital output for each shaft position across multiple shaft rotations and are capable of extremely high resolutions. Rockwell Automation absolute encoders are available with an enclosure rating of NEMA Type 4 and IP66, as well as a variety of mounting options. Applications include steel mills, overhead cranes, punch presses, transfer lines, oil rigs, wind mills, machine tools, and packaging.

Sine-cosine

A sine-cosine encoder is a position transducer using two sensors, each 90° out of phase with respect to the other. Sine-cosine encoders can be used directly by the drive or squared to provide a conventional A quad B digital signal. Therefore, the sine-cosine encoder can be used as an absolute, sine-cosine, or incremental feedback device.

Single-turn vs. multi-turn

Absolute encoders are either single-turn or multi-turn. Single-turn encoders are used if the absolute position of the shaft for one revolution is required. Multi-turn encoders are used if the absolute position is required for more than one shaft revolution.

842E encoder features

The 842E EtherNet/IP encoder features include:

- Support for the encoder profile 22h (0x22) defined in the Common Industrial Protocol (CIP™), according to IEC 61784-1
- Compatibility with star, linear and device level ring topology
- Robust nickel code disk for harsh ambient conditions
- Configurable resolution per revolution: 1 to 262,144
- High precision and availability
- Ball bearing spacing of 30 mm for longer life
- Face mount flange and servo flange/blind hollow shaft and through hollow shaft
- 18-bit single turn resolution
- 30-bit total resolution multi-turn resolution
- Endless shaft
- Flash update

IMPORTANT	A Series A encoder can not be updated to a Series B. A Series B encoder must be purchased in order to update future firmware. Series A does not have flash update capability.

Configurable parameters

The EtherNet/IP technology allows for certain encoder parameters to be configured over the network.

- Counting direction
- Counts per revolution
- Preset value
- Velocity output
- IP addressing

The electronic data sheet file

The electronic data sheet (EDS) file contains all the information related to the measuring-system-specific parameters as well as the operating modes of the 842E EtherNet/IP encoders. The EDS file is integrated using the EtherNet/IP network configuration tool to configure and place in operation the 842E EtherNet/IP encoder

For more information, go to www.rockwellautomation.com/resources/eds/ and search on “842E.”

Operating principle of the encoder

Operating principle of the 842E EtherNet/IP encoder acquires the position of rotating axes and outputs the position in the form of a unique digital numeric value. Optical acquisition of the rotary position value is from an internal coded disk.

The 842E-SIP-xxx EtherNet/IP is a singleturn encoder

Singleturn encoders are used if the absolute position of the shaft for one revolution is required.

The 842E-MIP-xxxEtherNet/IP is a multiturn encoder

Multiturn encoders are used if the absolute position is required for more than one shaft revolution.

Scalable resolution

The steps per revolution and the total resolution can be scaled and adapted to the related application.

The steps per revolution can be scaled in integers from 1…32,767 (Basic) or from 1…262,144 (Advanced). The total resolution of the 842E-MIP Multi-turn EtherNet/IP encoder must be 2H times the steps per revolution. This restriction is not relevant if the round axis or endless shaft functionality is activated.

842E EtherNet/IP is firmware flash gradable using Control Flash.

Special Features

Properties	Encoder	
	Single-turn	**Multi-turn**
Absolute Encoder in 60 mm design	▪	▪
Robust nickel coded disk for harsh environment	▪	▪
High precision and reliability	▪	▪
Large ball bearing spacing of 30 mm	▪	▪
High level of resistance to vibration	▪	▪
Optimal rotational accuracy	▪	▪
Compact design	▪	▪
Face mount flange, servo flange and blind	▪	▪
Hollow shaft	▪	▪
Firmware flash upgradable	▪	▪
18-bit single-turn resolution (1 to 262,144 steps)	▪	▪
30-bit total resolution		▪
12-bit multi-turn resolution (1…4,096 revolutions)		▪
Round axis functionality/endless shaft functionality		▪
EtherNet/IP interface (as per IEC 61784-1)	▪	▪
Supports the encoder profile 22h defined in the CIP (common industrial protocol)	▪	▪
Device level ring (DLR)	▪	▪

EtherNet/IP overview

Ethernet Industrial Protocol (EtherNet/IP) is a frame-based computer networking technology for local industrial area networks. It follows the seven layers of the Open Systems Interconnection model:

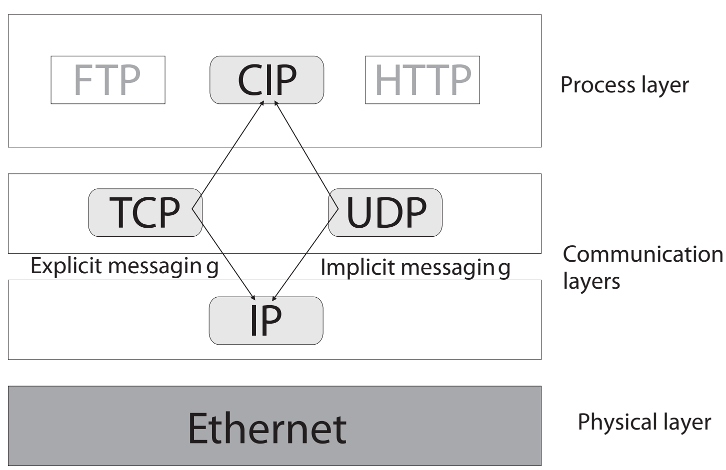
OSI Model

	Layer	Function
Host Layers	7. Application	Network process to application
	6. Presentation	Data, encryption
	5. Session	Inter-host communication Explicit and implicit messaging
	4. Transport	Flow control, TCP/UDP
Media Layers	3. Network	Internet protocol, logical addressing
	2. Data Link	Physical addressing
	1. Physical	Media, signal and binary transmission, peer-to-peer, multicast, unicast

Use of the Common Industrial Protocol

EtherNet/IP implements the Common Industrial Protocol (CIP), the application layer protocol specified for EtherNet/IP.

EtherNet/IP uses the CIP on the process layer. Similarly, as, for example, FTP is used for the transfer of files, this protocol is used for process control. The 842E encoder meets the requirements of the EtherNet/IP protocol according to IEC 61784-1 and those of the encoder profile.



The encoder is an I/O adapter in the EtherNet/IP. It receives and sends explicit and implicit messages either cyclic or on request (polled).

TCP/IP and UDP/IP

EtherNet/IP uses TCP/IP or UDP/IP for communication. (TCP is transmission control protocol and UDP is user datagram protocol.)

Implicit messaging is used for real-time communication between a programmable logic controller (PLC) and the encoder in EtherNet/IP. With implicit messaging a connection is established between exactly two devices within the CIP to transfer, for example, I/O data such as position or velocity from the encoder to the PLC. Implicit messaging uses UDP/IP via port 2222. As a result, a fast data rate is used.

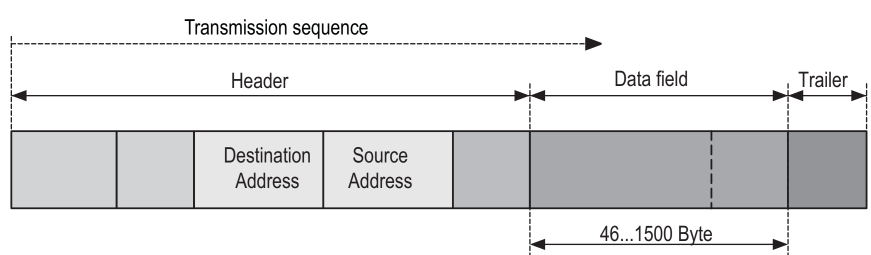
Explicit messaging is used in EtherNet/IP for communication that does not need to take place in real time. Explicit messaging uses TCP/IP; it is used, for example, to transfer parameters from the PLC to the encoder.

MAC address

Devices that originate or use data on the network have factory-assigned media access control (MAC) addresses for unique identification. The MAC address (MAC ID) consists of 6 bytes. The first three bytes identify the manufacturer. The last three bytes are unique to the device.   An example of a MAC address is 00:00:BC:C9: D7:14.

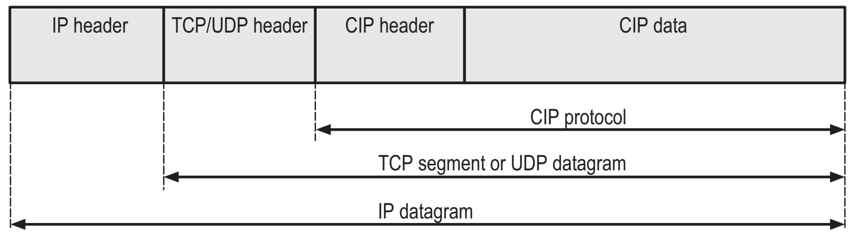
Communication frame

EtherNet/IP is based on the standard ethernet FRAME. This contains the ethernet header, the ethernet data and the ethernet trailer. The MAC addresses of the receiver (destination address) and of the source (source address) are contained in the ethernet header.



The ethernet data field consists of several nested protocols:

- The IP datagram is transported in the user data of the ethernet data field.
- The TCP segment or the UDP datagram are transported in the user data of the IP datagram.
- The CIP protocol is transported in the user data of the TCP segment or of the UDP datagram.



CIP is a message-based protocol that implements a relative path to send a message from the “producing” device in a system to the “consuming” devices.

The producing device contains the path information that steers the message along the proper route to reach its consumers. Because the producing device holds this information, other devices along the path simply pass this information; they do not need to store it.

This has two significant benefits:

- You do not need to configure routing tables in the bridging modules, which greatly simplifies maintenance and module replacement.
- You maintain full control over the route taken by each message, which enables you to select alternative paths for the same end device.

Understanding the producer/consumer model

The CIP “producer/consumer” networking model replaces the old source/destination (“master/slave”) model. The producer/consumer model reduces network traffic and increases speed of transmission. In traditional I/O systems, controllers poll input modules to obtain their input status. In the CIP system, input modules are not polled by a controller. Instead, they produce their data either upon a change of state or periodically. The frequency of update depends upon the options chosen during configuration and where on the network the input module resides. The input module, therefore, is a producer of input data and the controller is a consumer of the data.

The controller can also produce data for other controllers to consume. The produced and consumed data is accessible by multiple controllers and other devices over the EtherNet/IP network. This data exchange conforms to the producer/consumer model.

Specifying the requested packet interval

The requested packet interval (RPI) is the update rate specified for a particular piece of data on the network. This value specifies how often to produce the data for that device. For example, if you specify an RPI of 50 ms, it means that every 50 ms the device sends its data to the controller or the controller sends its data to the device.

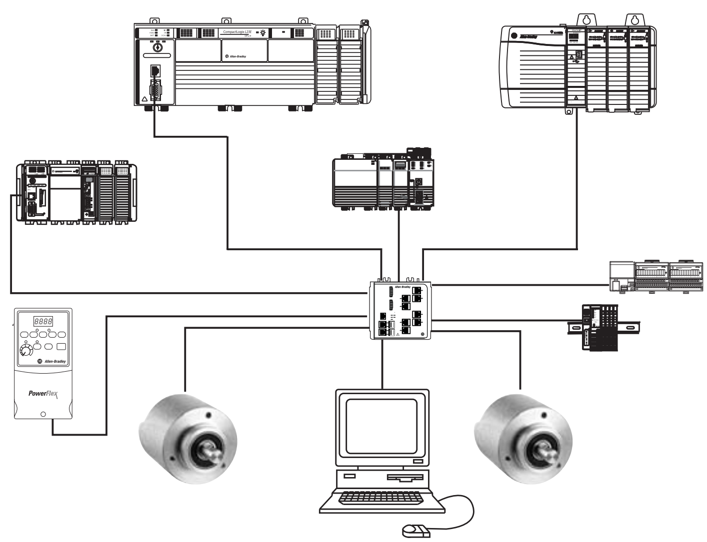
RPIs are only used for devices that exchange data. For example, a ControlLogix EtherNet/IP bridge module in the same chassis as the controller does not require an RPI because it is not a data-producing member of the system; it is used only as a bridge to remote modules.

EtherNet/IP topologies

The 842E encoders can be connected in any of three network topologies: star, linear or device level ring (DLR).

IMPORTANT	Rockwell Automation recommends that you use no more than 50 nodes on a single DLR or linear network. If your application requires more than 50 nodes, we recommend that you segment the nodes into separate, but linked, DLR or linear networks.

Star topology

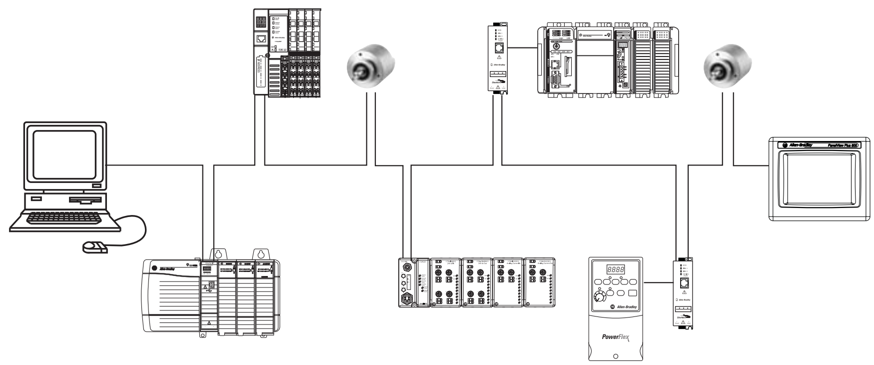


The star structure consists of a number of devices connected to a central switch.

IMPORTANT	When this topology is used, make the ethernet connection on the 842E encoder to the Link 1 connection. The Link 2 ethernet connection must remain unused.

Linear topology

The linear topology uses the embedded switching capability to form a daisy-chain style network that has a beginning and an end. Linear topology simplifies installation and reduces wiring and installation costs, but a break in the network disconnects all devices downstream from the break. When this topology is used, both ethernet connections on the encoder may be used. For the network connection use Link 1, Link 2, or both.



Endless Shaft Functionality

The endless-shaft feature is not supported for the single-turn encoder. This functionality is applicable only for the multi-turn Ethernet encoders.

The round axis functionality or endless shaft functionality removes the restriction that the total resolution must be 2H times the steps per revolution. The shaft is considered an endless shaft.

The steps per revolution are not configured directly. Instead the nominator and divisor for the number of revolutions are defined. The total measuring range can be scaled from 1…1,073,741,824 as an integer.

The encoder supports the function for round axes. During this process, the steps per revolution are set as a fraction. As a result, the total resolution does not have to be configured to 2H times the steps per revolution and can also be a decimal number. The output position value is adjusted with the zero point correction, the counting direction set and the gearbox parameters entered.

Number of revolutions, nominator for the round axis functionality: The nominator can be scaled from 1…2,048 as an integer. The default factory setting for the nominator is 2,048.

Number of revolutions, divisor for the round axis functionality: The divisor can be scaled from 1…65,535 as an integer. The default factory setting for the divisor is 1.

Example:

A rotary table for a filling system is to be controlled. The steps per revolution are predefined by the number of filling stations. There are nine filling stations. For

the precise measurement of the distance between two filling stations, 1000 steps are required.

The number of revolutions is pre-defined by the transmission ratio = 12.5 of the rotary table gearing. The total resolution is then 9 × 1,000 = 9,000 steps, to be realized in 12.5 revolutions of the encoder. This ratio cannot be realized via the steps per revolution and the total resolution, as the total resolution is not 2H times the steps per revolution. The application problem can be solved using the round axis functionality. The steps per revolution are ignored here. The total resolution as well as the nominator and divisor for the number of revolutions are configured. 9,000 steps are configured as the total resolution. For the nominator for the number of revolutions 125 is configured, 10 as the divisor (125/10 = 12.5). After 12.5 revolutions (that is after one complete revolution of the rotary table) the encoder reaches the total resolution of 9,000.

Test:

In this example, we will be issuing incremental MAM motion commands to the K6500 CIP axis, & compare accuracy against 842E-M position tag.

Verify the measuring range (unwind) position rolls-over correctly when approach from both CW and CCW directions.

See the tables attached for specific test intervals based on the numerator, denominator, and measurement ranges selected.

Measuring Range Test

Numerator	Denominator	Measuring Range (CMR)	Bi-Directional Rollover Test Pass/Fail 1	One Rev Distance Check Test 2	One Rev Distance Accuracy (counts)	NOTES
1	1	0	n/a	n/a	n/a	Message Instruction Errors – this is expected operation
1	1	1	Pass	Pass	0	Position does not change. This is the expected operation.
1	1	2	Pass	Pass	0	
1	1	4	Pass	Pass	0	
1	1	8	Pass	Pass	0	
1	1	16	Pass	Pass	0	
1	1	1,024	Pass	Pass	0	
1	1	4,096	Pass	Pass	0	
1	1	16,535	Pass	Pass	1	
1	1	262,144	Pass	Pass	1	
1	1	262,150	Pass	Pass	1	Position Rolls-over @ 262,144 This is expected behavior as the CMR limit is 262,144 based on the following formula **CMR** = (CNR_N / CNR_D) * CPR where CPR = 262,144
1	1	524,288	Pass	Pass	1	Position Rolls-over @ 262,144 This is expected behavior as the CMR limit is 262,144 based on the following formula **CMR** = (CNR_N / CNR_D) * CPR where CPR = 262,144
2	1	524,288	Pass	Pass	1	Position Rolls-over @ 524,288 This is expected behavior as the CMR limit is 262,144 based on the following formula **CMR** = (CNR_N / CNR_D) * CPR where CPR = 262,144
2	1	1,048,576	Pass	Pass	1	Position Rolls-over at 524,288 This is expected behavior as the CMR limit is 524,288 based on the following formula **CMR** = (CNR_N / CNR_D) * CPR where CPR = 262,144
1	1	536,870,912	Pass	Pass	1	Position Rolls-over @ 262,144

Numerator Test

Numerator (CNR_N)	Denominator (CNR_D)	Measuring Range (CMR)	Bi-Directional Rollover Test Pass/Fail	One Rev Distance Check Test Pass/Fail	Distance Accuracy (counts)	NOTES
0	1	262,144	n /a	n / a	n/a	Message Instruction Errors – this is expected operation
2	1	262,144	Pass	Pass	0 - 1	131,072 counts per turn of the encoder
4	1	262,144	Pass	Pass	0 - 1	65,536 counts per turn of the encoder
8	1	262,144	Pass	Pass	0 - 1	32,768 counts per turn of the encoder
16	1	262,144	Pass	Pass	0 - 1	16,384 counts per turn of the encoder
32	1	262,144	Pass	Pass	0 - 1	8,196 counts per turn of the encoder
64	1	262,144	Pass	Pass	0 - 1	4.096 counts per turn of the encoder
128	1	262,144	Pass	Pass	0 - 1	2,048 counts per turn of the encoder
256	1	262,144	Pass	Pass	0 - 1	1,024 counts per turn of the encoder
512	1	262,144	Pass	Pass	0 - 1	512 counts per turn of the encoder
1024	1	262,144	Pass	Pass	0 - 1	256 count per turn of the encoder
2048	1	262,144	Pass	Pass	0 - 1	128 count per turn of the encoder
2049	1	262,144	n/a	n/a	n/a	Message Instruction Errors – this is expected operation

Denominator Test

Numerator	Denominator	Measuring Range (CMR)	Bi-Directional Rollover Test Pass/Fail	One Rev Distance Check Test	One Rev Distance Accuracy (counts)	NOTES
1	0	262,144	Pass	Pass	n/a	Message Instruction Errors – this is expected operation
1	2	262,144	Pass	Pass	Pass	I.Position doesn't update and remains at zero. The is expected behavior as the CMR limit is 131072 based on the following formula **CMR** = (CNR_N / CNR_D) * CPR where CPR = 262,144
1	4	262,144	Pass	Pass	Pass	Outside CMR Limit – See description above
1	8	262,144	Pass	Pass	Pass	Outside CMR Limit – See description above
1	16	262,144	Pass	Pass	Pass	Outside CMR Limit – See description above
1	32	262,144	Pass	Pass	Pass	Outside CMR Limit – See description above
1	64	262,144	Pass	Pass	Pass	Outside CMR Limit – See description above
1	128	262,144	Pass	Pass	Pass	Outside CMR Limit – See description above
1	256	262,144	Pass	Pass	Pass	Outside CMR Limit – See description above
1	512	262,144	Pass	Pass	Pass	Outside CMR Limit – See description above
1	1024	262,144	Pass	Pass	Pass	Outside CMR Limit – See description above
1	2048	262,144	Pass	Pass	Pass	Outside CMR Limit – See description above
1	4096	262,144	Pass	Pass	Pass	Outside CMR Limit – See description above
1	65535	262,144	Pass	Pass	Pass	Outside CMR Limit – See description above
1	65536	262,144	Pass	Pass	Pass	Message Instruction Errors – this is expected operation

Other Ratios Tested

Numerator	Denominator	Measuring Range (CMR)	Bi-Directional Rollover Test Pass/Fail	One Rev Distance Check Test	One Rev Distance Accuracy (counts)	NOTES
2	2	4096	Pass	Pass		
2	4	4096	Pass	Pass		I.Position traverses 2 cyles / turn of the encoder with an unwind at 4096
2	8	4096	Pass	Pass		I.Position traverses 4 cycles / turn of the encoder with an unwind at 4096
2	32	4096	Pass	Pass		I.Position traverses 16 cycles / turn of the encoder with an unwind at 4096
16	32	4096	Pass	Pass		I.Position traverses 2 cyles / turn of the encoder with an unwind at 4096
16	32	131072	Pass	Pass		I.Position traverses 2 cyles / turn of the encoder with an unwind at 131072
16	32	131073	Pass	Pass		I.Position doesn't update and remains at zero. The is expected behavior as the CMR limit is 131072 based on the following formula **CMR** = (CNR_N / CNR_D) * CPR where CPR = 262,144
8	32	65536	Pass	Pass		I.Position traverses 4 cyles / turn of the encoder with an unwind at 65536
8	32	65537	Pass	Pass		I.Position doesn't update and remains at zero. The is expected behavior as the CMR limit is 65536 based on the following formula **CMR** = (CNR_N / CNR_D) * CPR where CPR = 262,144

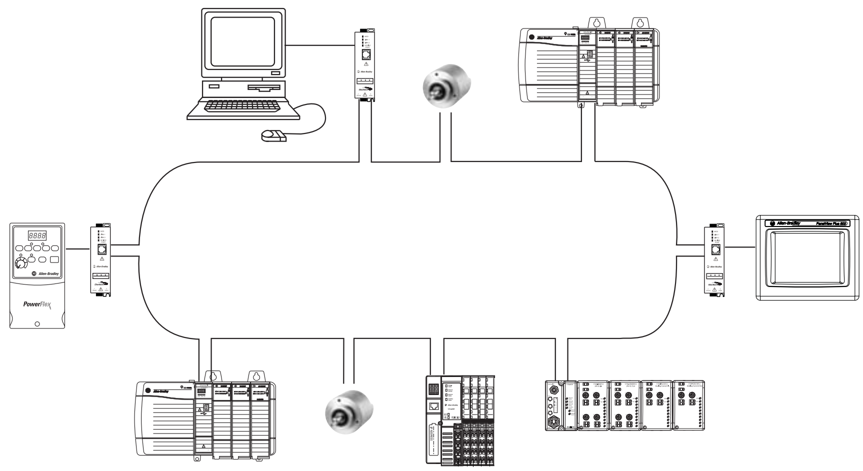
Features:

Attribute 14 (e hex)	Scaling Function Control (SFC)
Attribute 125 (7d hex)	Endless Shaft Functionality (ESF)
Attribute 126 (7e hex	Nominator (CNR_N)
Attribute 127 (7f hex)–	Divisor (CNR_D)
Attribute 17 (11 hex)	Total Measuring Range (CMR)

IMPORTANT	Making online scaling changes, through the modules profile, is not allowed unless the encoder device is inhibited. Executing online changes will display an error message “Failed to modify properties. Failed to send configuration data to the module.” Consequently changes will be ignored. Online changes should be noted as “not allowed” in our documentation.

Device level ring topology

A DLR network is a single-fault-tolerant ring network intended for the interconnection of automation devices. DLR topology is advantageous as it can tolerate a a break in the network. If a break is detected, the signals are sent out in both directions. With this topology, use both the Link 1 and Link 2 ethernet connections on the 842E encoder.



CIP object model

EtherNet/IP uses an object model for network communication wherein all functions and data of a device are defined. The important terms are as follows:

Class: A class contains related objects of a device, organized in instances.

Instance: An instance consists of different attributes that describe the properties of the instance. Different instances of a class have the same services, the same behavior, and the same attributes. They can, however, have different values.

Attribute: The attributes represent the data a device provides over EtherNet/IP. These include the current values of, for example, a configuration or an input. Typical attributes are configuration and status information.

Service: Services are used to access classes or the attributes of a class or to generate specific events. These services execute defined actions such as reading the attributes.

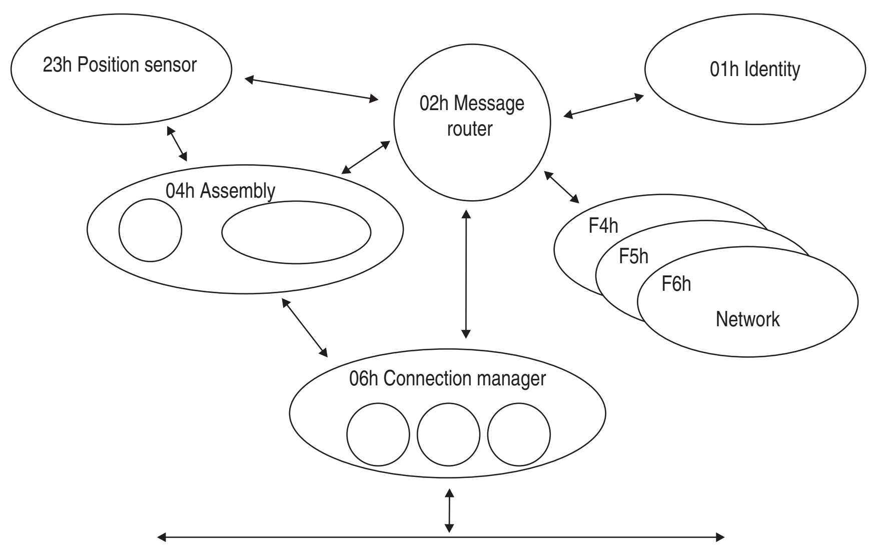
The following table shows an example of the object model for the 842E encoders.

Class	Instance	Attribute	Value
842E	Basic	Resolution per revolution	15 bit
		Revolutions, total	12 bit
	Advanced	Resolution per revolution	18 bit
		Revolutions, total	12 bit

The 842E EtherNet/IP encoder supports the following classes of the encoder profile:

Supported classes

Class code	Object class	Description	Number of instances
0x01	Identity object	Contains information on the node within the network	1
0x02	Message router object	Processes all messages and routes them to the appropriate objects	1
0x04	Assembly object (I/O-assembly class)	Assembles attributes (data) of various objects to a single object Used for I/O messages	7
0x06	Connection manager object	Contains connection specific attributes for triggering, transport, and connection type	1
0x23	Position sensor object	Administrates device specific data like position and counting direction	1
0x47	Device level ring (DLR) object	Contains the configuration and status information of the DLR protocol	1
0x48	QoS object	Contains mechanisms used to treat traffic streams with different relative priorities	1
0xF4	Port object	Contains implemented port types port numbers and port names	1
0xF5	TCP/IP interface object	Contains all attributes for configuring the TCP/IP interface	1
0xF6	Ethernet link object	Contains connection-specific attributes like transmission rate, MAC address, or duplex mode	3



The Class Instance Attributes for the position sensor object are provided in the tables below.

See Appendix B on page 59 for an example of how to create an explicit message in RSLogix 5000 using the position sensor object tables.

Class services of the position sensor object

Instance	Service Name	Description
0x05	Reset	Reboot with all EEProm parameters of the encoder, reboot with the factory defaults 00: reboot Object– read all EEProm parameters 01: set and save factory defaults and reboot object– read all EEProm parameter
0x0E	Get_Attribute_Single	Returns value of attribute
0x15 (21dec)	Restore	Restore all parameter values from the non-volatile storage, customer defaults
0x16 (22dec)	Save	Save parameters to the non-volatile storage

Class attributes of the position sensor object

Num (dec)	Required/ optional	Access rule	Name	Data type	Description	Default
1	Required (implemented)	Get	Revision	INT	Object revision no	0x00 02
2	Implemented	Get	Max instance	INT	Max. instance number of an object in this class	0x00 01
3	Implemented	Get	Number of instances	INT	Number of object instances in this class	0x00 01
6	Implemented	Get	Maximum ID number class attributes	INT	Highest implemented class ID	0x00 64
7	Implemented	Get	Maximum ID number instance attributes	INT	Highest implemented instance attribute ID	0x00 7A
100	Get	NV (1)	Encoder firmware version	ARRAY of bytes	aa.bb: major revision minor revision dd.mm.yy: day.month.year	842eaa.bb dd.mm.yy

(1) Nonvolatile

Instance Services of the position sensor object are automatically populated in the explicit message instruction configuration

Instance services of the position sensor object

Instance	Service name	Description
0x0E	Get_Attribute_Single	Returns value of attribute
0x10	Set_Attribute_Single	Sets value of attribute

1Instance attributes of the position sensor object

Attribute ID (dec)	Attribute ID (hex)	Access rule (1)	NV / V (2)	Name	Data type	Description	Min. / max (default)
1	1	Get	V	Number of attributes	INT	Number of supported attributes in this class	0x0039
2	2	Get	V	Attribute list	ARRAY of byte	List of supported attributes	–
10	A	Get	V	Position value signed	DINT	Current position value (32 Bit)	none
11	B	Get	NV	Position sensor type (see following table, encoder ID)	INT	Device Type 0x01: Single-turn absolute encoder 0x02: Multi-turn absolute encoder	Min 0x00 01 Max 0x00 02 (0x00 02)
12	C	Set	NV	Direction counting toggle, code sequence (CS)	BOOL	Definition of direction of incrementing counts (10) 0: CW 1:CCW	(0: CW)
13	D	Set	NV	Commissioning diagnostic control (encoder position test)	BOOL	ON: 1 Encoder diagnostics possible OFF: 0 No diagnostics implemented	(OFF: 0)
14	E	Set	NV	Scaling function control (SFC)	BOOL	ON: 1 calc. value (from 16+42) OFF: 0 phys. resolution [steps]	(OFF: 0)
15	F	Set	NV	Position format	ENG UNIT	Format of position value (e.g., arcsec or steps) Engineering unit: 0x1001 (counts)	(0x1001)
16	10	Set	NV	Counts per range	DINT	Number of requested steps per revolution.	Min 0x00 00 00 01 Max 0x00 04 00 00 (0x00 04 00 00)
17	11	Set	NV	Total measuring range	DINT	Total resolution	Min / Max 0x00 00 00 01 / Max. 2^n * Attr.16 (Max. 2^n * Attr.16)
18	12	Set	NV	Position measuring increment	DINT	Minimum resolution in steps (is always 0x00 01)	(0x00 00 00 01)
19	13	Set	NV	Preset value	DINT	The preset value is set to the current position value	Min / Max 0x00 00 00 00 / Attr.17 - 1 (0x00 00 00 00)
21	15	Get	V	Position status register	BYTE	State of the software limit switch Bit 0: Out of range Bit 1: Range overflow Bit: 2: Range underflow Bit 3…7 reserved	(0x00)
22	16	Set	NV	Position low limit	DINT	Lower limit for position	0x00 00 00 00
23	17	Set	NV	Position high limit	DINT	Upper limit for position	0x3F FF FF FF
24	18	Get	V	Velocity value	DINT	Current velocity (32 Bit)	Format (25) und (26)
25	19	Set	NV	Velocity format	ENG INT	Format of velocity value 0x1F04 counts/s 0x1F0E revs/s 0x1F0F revs/min	(0x1F0F)
26	1A	Set	NV	Velocity resolution	DINT	Minimum resolution of velocity value (24)	(0x00 00 00 01)
27	1B	Set	NV	Minimum velocity setpoint	DINT	Minimum velocity set-point for setting warning flag (47)	(0x00 00 00 00)
28	1C	Set	NV	Maximum velocity setpoint	DINT	Maximum velocity set-point for setting warning flag (47)	(0x3F FF FF FF)

Attribute ID (dec)	Attribute ID (hex)	Access rule [1]	NV / V [2]	Name	Data type	Description	Min. / max (default)
29	1D	Get	V	Acceleration value	DINT	Current acceleration (32 Bit)	Format (30) und (31)
30	1E	Set	NV	Acceleration format	ENG UNIT	Format of acceleration value 0x0810: cps/s 0x0811: rpm/s 0x0812: rps/s	(0x0810)
31	1F	Set	NV	Acceleration resolution	DINT	Minimum resolution of acceleration value	(0x00 00 00 01)
32	20	Set	NV	Minimum acceleration setpoint	DINT	Minimum acceleration set-point	(0x00 00 00 00)
33	21	Set	NV	Maximum acceleration setpoint	DINT	Maximum acceleration set-point	0x3F FF FF FF
41	29	Get	V	Operating status	BYTE	Operating status encoder Bit 0: Direct. 0 (inc.) 1 (dec.) Bit 1: Scaling 0 (off) 1 (on) Bit: 2…4 Reserved Bit: 5: Diag. 0 (off) 1 (on) Bit 6…7 manuf. spec.	
42	2A	Get	NV	Physical resolution span (PRS)	DINT	Number of steps per rev Basic = 15 bit Advanced = 18 bit (single-turn part)	(0x00 04 00 00)
43	2B	Get	NV	Physical resolution number of spans	INT	Number of revolutions (multi-turn part)	(0x00 01) single (0x10 00) multi
44	2C	Get	V	Alarms	WORD	Flags for alarms (errors)	
45	2D	Get	NV	Supported alarms	WORD	Information on supported alarms	0x3003
46	2E	Get	V	Alarm flag	BOOL	Indication of set alarm	0: OK 1: Alarm error
47	2F	Get	V	Warnings	WORD	Flags for warnings	
48	30	Get	NV	Supported warnings	WORD	Information on supported warnings	0x673C
49	31	Get	V	Warning flag	BOOL	Indication of set warning	0: OK 1: Warning Flag
50	32	Get	NV	Operating time	DINT	Storage of operating time counter [0,1h], the format of the counter is second.	0
51	33	Get	NV	Offset value	DINT	Offset value is calculated when using preset function	0x00 00 00 00
100	64	Get	V	Temperature value	INT	Current temperature value -40…100°C or -40…212°F Accuracy of the temperature sensor is about +/- 5 °C.	0xF0 60 0x27 10 (-4000… +10000)
101	65	Set	NV	Temperature value format	ENG UNIT	Format of temperature value °C or °F (Fahrenheit) 0x1200: °C 0x1201: °F	(0x1200)
102	66	Set	NV	Temperature resolution	DINT	Minimum resolution of temperature value [°C/100] or [(°F)/100]	(0x00000001)
103	67	Set	NV	Minimum temperature value setpoint	INT	Minimum temperature set-point (-40…100°C, -40…212°F)	0xF0 60 (-4000)

Attribute ID (dec)	Attribute ID (hex)	Access rule (1)	NV / V (2)	Name	Data type	Description	Min. / max (default)
104	68	Set	NV	Maximum temperature value setpoint	INT	Maximum temperature set-point (-40…100°C, -40…212°F)	0x27 10 (+10000) or 0x52D0 (+21200)
105	69	Get	V	Fault header (see Sensor error table)	DINT	Flags of encoder sensor errors and warnings	0x00 00 00 00
106	6A	Set	NV	Slave sign of live	DINT	Flags for encoder functionalities (Bit-field): Bit 0: Slave sign of live (on/off) Bit 1…7: not used Bit 8…15: UpdateFactor (1…127) Bit 16…31: not used	0x0000500
107	6B	Get	NV	Encoder motion time	DINT	Storage of the motion time. This counter is incrementing if the encoder is in rotation [sec].	0
108	6C	Get	NV	Encoder operating time [second]	DINT	Storage of the operating time. This counter is incrementing if the encoder is powered on [sec].	0
109	6D	Get	NV	Max velocity RA [cnts/ms]	DINT	Storage of the maximum velocity of the encoder in operational state.	0
110	6E	Get	NV	Max acceleration [cnts/(ms)2]	DINT	Storage of the maximum acceleration of the encoder in operational state.	0
111	6F	Get	NV	Max temp [°C/100]	DINT	Storage of the maximum temperature of the encoder in operational state	2000
112	70	Get	NV	Min temp [°C/100]	DINT	Storage of the minimum temperature of the encoder in operational state	2000
113	71	Get	NV	Number of startups	DINT	Storage of the number of startups (power-on) cycles	0
114	72	Get	V	LED current value [µA]	INT	Current LED current [µA] Range: 200…25.000	200…25.000 (0)
115	73	Get	NV	Max current value [µA]	INT	Max. LED current [µA]	1.500
116	74	Get	NV	Min current value [µA]	INT	Min. LED current [µA]	1.500
117	75	Get	V	Power supply voltage [mV] Accuracy is about 1% from the measurement value.	INT	Current supply voltage [mV] Range: 9.500…30.500	9.500…30.500 (24.000)

(1) You can do a **Get** of all the **Set** values, as shown in Appendix B, page 59. It is always good programming practice to do a Get after setting a value to ensure the Set command was successful.

(2) Nonvolatile/volatile

Chapter 4

Installation

Mechanical

This chapter describes how to install the 842E EtherNet/IP Encoder.

Also refer to the installation sheet provided in the box, **Publication No. 100000169360**.

Shaft rotation direction

When you view the encoder from the shaft side, the shaft rotation is clockwise (CW) or counterclockwise (CCW), as shown.

Mounting with a solid shaft

1. Be sure to select the proper size flexible coupling clamp to mate to the encoder shaft, e.g., 845–FC–*–*. See encoder accessories in the *Sensors* catalog.

ATTENTION	Do not rigidly connect the encoder shaft to the machine; this will cause premature failure of the encoder or machine bearings. Always use a flexible coupling.

2. Use the dimension drawings in the installation instructions to determine the encoder mounting hole locations (see “Related documentation” on page iii).
3. Slide the flexible coupling onto the shaft, but do not tighten the set screws.
4. Mount the encoder and tighten with three size M4 mounting screws (not supplied).
5. Center the flexible coupling and tighten the set screws.

6. Rotate the machine slowly and verify that the flexible coupling is not deforming beyond specifications.
7. Align machine to its mechanical zero or home position.
8. Remove the screw cover on the back of the encoder and press the preset push button to change the preset value to the current shaft position value. (The factory preset value is zero.)
9. Replace the screw cover.

Mounting with a hollow shaft

IMPORTANT	Be sure the mating shaft is chamfered and grease-free.

1. Loosen the screw on the clamping ring with a 2.5-mm star driver.
2. Slide the encoder onto the mating shaft until the flex mount rests on the machine surface.

ATTENTION	The encoder should slide freely onto the shaft; if not, do not force. Check the shaft for interferences such as gouges, burrs, rust, or size.

3. Hold encoder firmly and mark the two mounting holes. (If mounting holes already exist, proceed to Step 6.)
4. Slide the encoder off. Drill and tap the marked holes to accept M4 (or equivalent) screws.
5. Slide the encoder back onto the shaft until the flex mount rests on the machine surface.
6. Attach the encoder with two M4 (or equivalent) screws.

IMPORTANT	Do not stress the flex mount while tightening the screws.

7. Tighten the clamping ring screw to 1.1 Nm (10 in–lb).
8. Align machine to its mechanical zero or home position.
9. Remove the screw cover on the back of the encoder and press the preset push button to change the preset value to the current shaft position value. (The factory preset value is zero.)
10. Replace the screw cover.

Mechanical specifications

Face mount flange	10 x 19 mm
Servo flange	6 x 10 mm
Blind hollow shaft	8, 19, 12, 15 mm and 1/4, 1/2, 3/8, 5/8 in.

Electrical

ATTENTION

Switch off the power supply. The machine/system could unintentionally start while you are connecting the devices.

Ensure that the entire machine/system is disconnected during the electrical installation.

ATTENTION

Commissioning requires a thorough check by authorized personnel!

Before you operate a system equipped with the 842E EtherNet/IP absolute encoder, make sure that the system is first checked and released by authorized personnel.

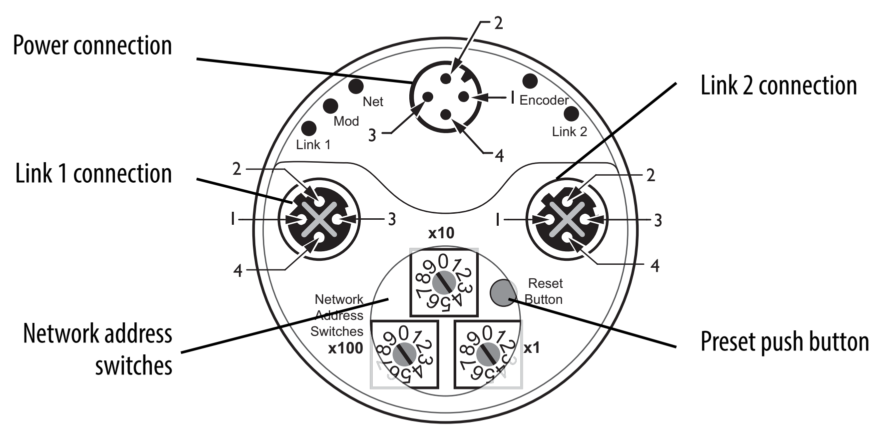
Please read more in Chapter 1, Safety.

Electrical wiring instructions

Three electrical connections are located on the back of the housing.

A 4-pin M12 connector is used for the power supply connection.

Two 4-pin M12 connectors are used for the ethernet connection. The Link 1 connection is used for star networks. For ring networks, use both the Link 1 and Link 2 connectors. In a linear network, use Link 1, Link 2, or both connectors.



Pin assignments

Voltage supply			
Pin	**Signal**	**Mating cable wire color**	**Function**
1	Vs	Brown	Supply voltage 10…30V DC
2		White	Do not use
3	GND	Blue	0V DC (ground)
4		Black	Do not use

Ethernet Link Connections – Link 1 and Link 2			
Pin	**Signal**	**Mating Cable Wire Color**	**Function**
1	TxD+	White orange	Ethernet
2	RxD+	White green	Ethernet
3	TxD–	Orange	Ethernet
4	RxD–	Green	Ethernet

Preset push button

ATTENTION	Pressing the preset push button results in a change of position reading. This can cause unexpected motion which could result in personal injury or damage to the product or equipment.

IMPORTANT	Press the preset button briefly, no longer than one second.

To preset the position of the encoder, remove the screw cover from the back of the encoder and briefly press the Preset button inside (see figure on page 25 and “Preset function” on page 46).

Network address switches

You can use the three Network Address switches to set the IP address of the encoder (see figure on page 31 and “Setting the IP Address” on page 29).

Electrical specifications

Operating voltage	10…30V DC
Power consumption	3 W
Load current	200 mA
Resolution per revolution	262,144
Revolutions	4,096
Repeat accuracy	±0.002°
Error limit	±0.03°
Code direction	CW or CCW programmable
Interface	EtherNet/IP per IEC 61784-1
Transmission speed	100 MBits/s
Duplex	Full or half

Notes:

Configuring the encoder for your EtherNet/IP network

Setting the IP Address

The 842E encoder is shipped with the network address switches set to 888. You must assign it an IP address using one of the two methods outlined below.

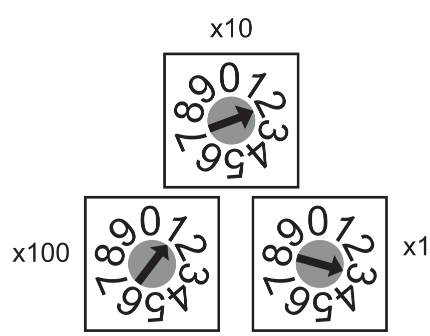
You can set the IP address of the 842E encoder using either one of the following methods:

1. Use the network address switches (see figure on page 25) on the encoder to set the last octet of the IP address (192.168.1.xxx).
2. Use the network address switches to enable BootP / DHCP and use a BootP utility or DHCP server to assign the IP address of the unit on powerup.

Assigning the last octet in an IP address scheme of 192.168.1.xxx using the network address switches

1. Set the three network address switches to 999.
2. Cycle power to the encoder.
3. Set the three network address switches to a valid address of 001 – 254.
4. Cycle power to the encoder.
5. The encoder will power up with the IP address set to 192.168.1.xxx, where xxx is the position of the three network address switches.

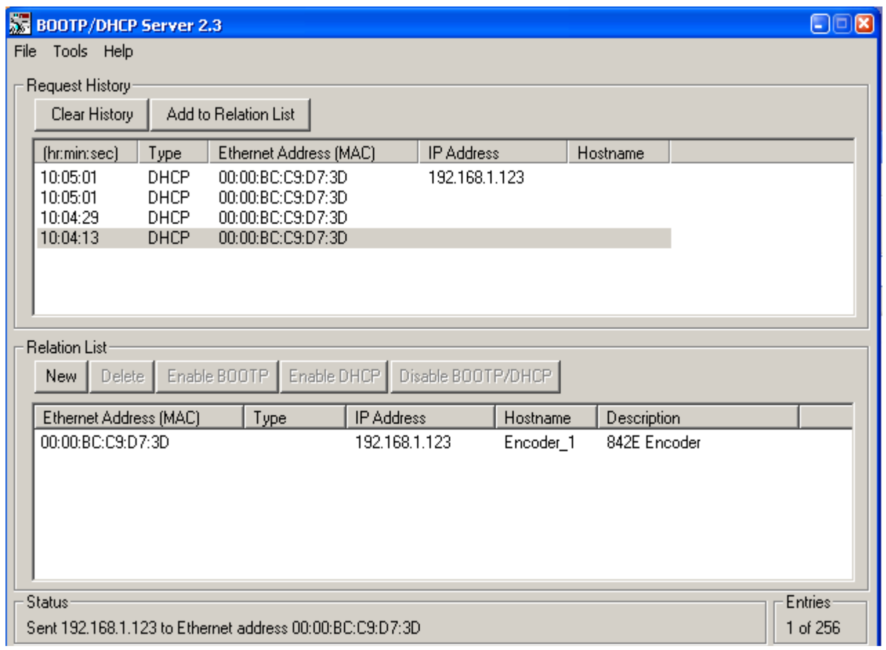
Network address switches set to 123



Assigning the IP Address using BootP/DHCP:

Verify that the encoder's MAC ID is in the relationship list in the BootP Utility or DHCP server before attempting to assign the encoder an IP address using this procedure.

1. Set the three network address switches to 999 and cycle power.
2. Set the three network address switches to 000 and cycle power.
3. The encoder will power up and request an IP address from a BootP/DHCP server.
4. If the encoder's MAC ID is in the relationship list, the BootP/DHCP server will assign the associated IP address to the corresponding MAC ID.



Function of network address switch settings

Setting of network address switches	Function
001-254	Sets last octet of the IP address to the value indicated (xxx in 192.168.1.xxx)
888	Restores all factory default settings in the encoder and clearing its IP address
999	Clears the encoder's IP address

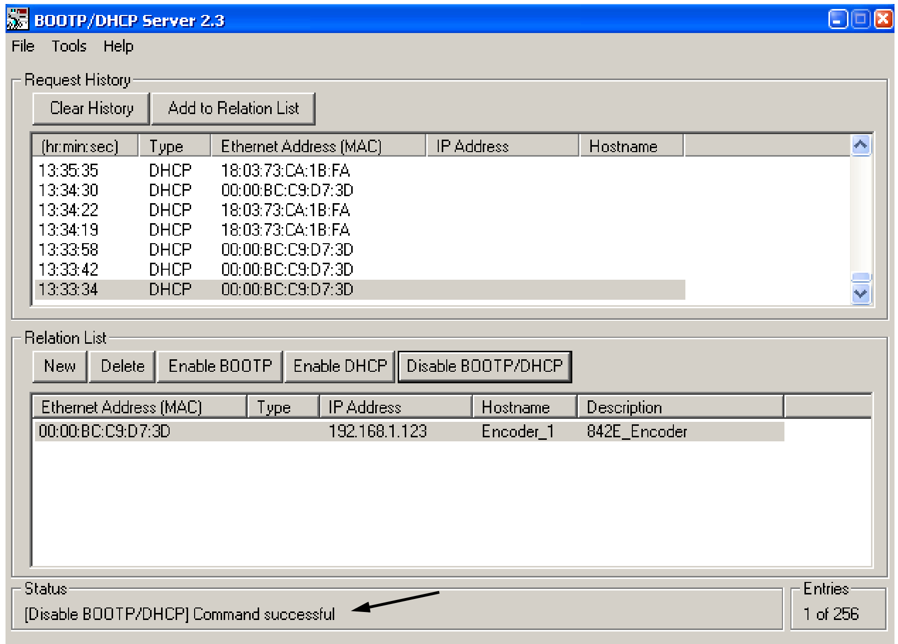
ATTENTION

Disable DHCP after the new network address is set (see next step).

This prevents unexpected resetting of the network address, which could result in unintended machine motion or loss of process control.

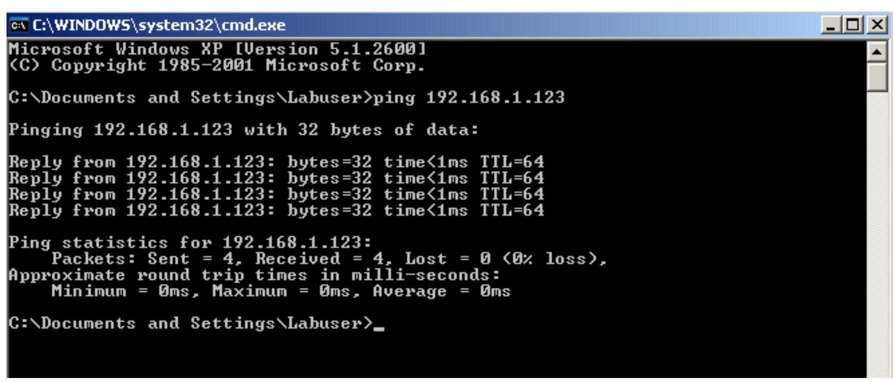
5. Disable DHCP: click once on the encoder in the relation list to highlight it. Then click **Disable BOOTP/DHCP**. This instructs the 842E encoder to retain the IP address at the next power cycle.

   Wait for the status message to show that the command was successfully sent. If the message does not appear, repeat this step.



6. Click **File > Save As** to save the relationship, if desired.
7. Cycle the power to the 842E encoder. You should no longer see the 842E encoder appear in the request history panel.

From a DOS prompt, you can ping the new address. The response should be 4 packets sent, 4 packets received, and 0 lost.



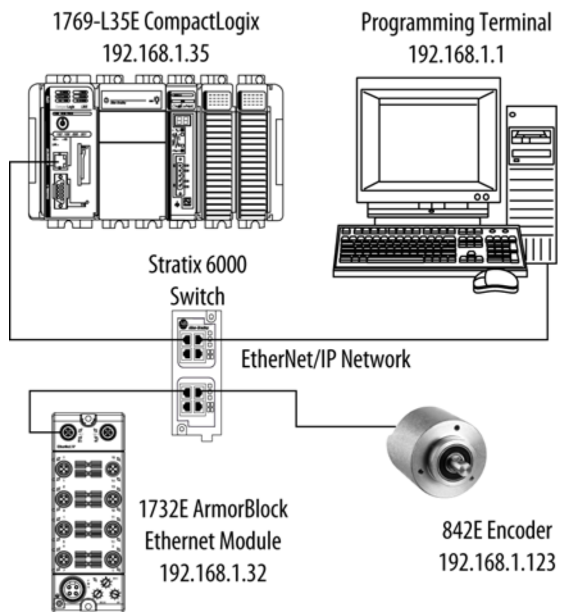
Notes:

Configuring the 842 E encoder using RSLogix 5000

This chapter guides you through the steps required to configure your encoder using RSLogix 5000 software. Note that the modules presented in this chapter are configured using RSLogix 5000 software, version 20.

Example: setting up the hardware

In this example, a CompactLogix™ chassis contains the L35E processor in slot 1 and a built-in EtherNet/IP connection. The encoder is connected to a Stratix 6000 ethernet switch.



To work along with this example set up your system as shown.

- Verify the IP addresses for your programming terminal and 842E encoder.
- Verify that you connected all wiring and cabling properly.
- Be sure you configured your communication driver (for example, AB_ETH-1 or AB-ETHIP-1) in the RSLinx® software.

Configuring the encoder

You must configure your encoder upon installation. The encoder will not work until it has been configured with at least the default configuration.

RSLogix 5000 configuration software

You must use RSLogix 5000, version 18 or later to set configuration for your encoder. The instructions in this chapter use version 20.

You have the option of accepting default configuration for your encoder or writing point level configuration specific to your application. Both options are explained in detail, including views of software screens, in this chapter.

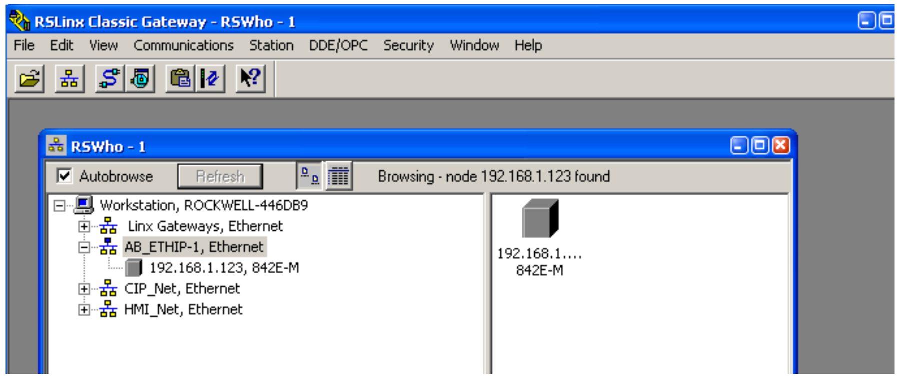
Checking the integration in EtherNet/IP via RSLinx Classic

With the aid of the tool RSLinx Classic you can again check whether the IP address set is detected by the control system.

The EDS file (electronic data sheet) contains all the information related to the parameters as well as the operating modes of the EtherNet/IP encoder (go to www.rockwellautomation.com/resources/eds/ and search on "842E," also see "The electronic data sheet file" on page 5). You can register the EDS file using the EDS hardware installation tool in the tools menu of RSLinx Classic software.

1. Start RSLinx Classic (as a rule on the Start menu on your PC/notebook in Rockwell Software, RSLinx, RSLinx Classic).
2. Click on the **RSWho** button in the program.

3. Then open the path **AB_ETHIP1, ethernet**. The encoder can be seen with its IP address.



4. Install the add-on profile according to the instructions in Appendix A, page 55.

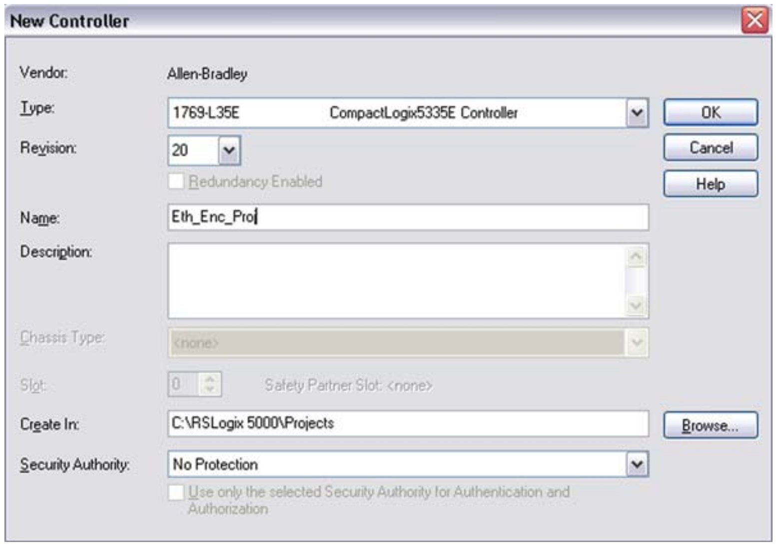
IMPORTANT Before proceeding, install the add-on profile (see Appendix A, page 55).

Setting up the add-on profile in RSlogix 5000

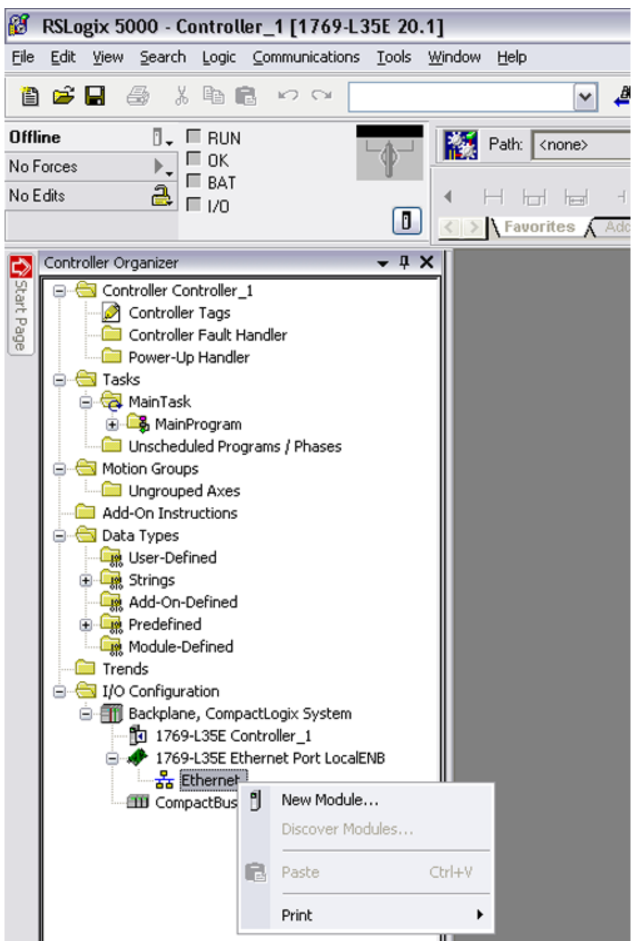
After you install the encoder add-on profile (see Appendix A, page 55), set up the add-on profile; here is an example of the setup procedure.

1. Open RSLogix 5000.
2. Click **File>New**.

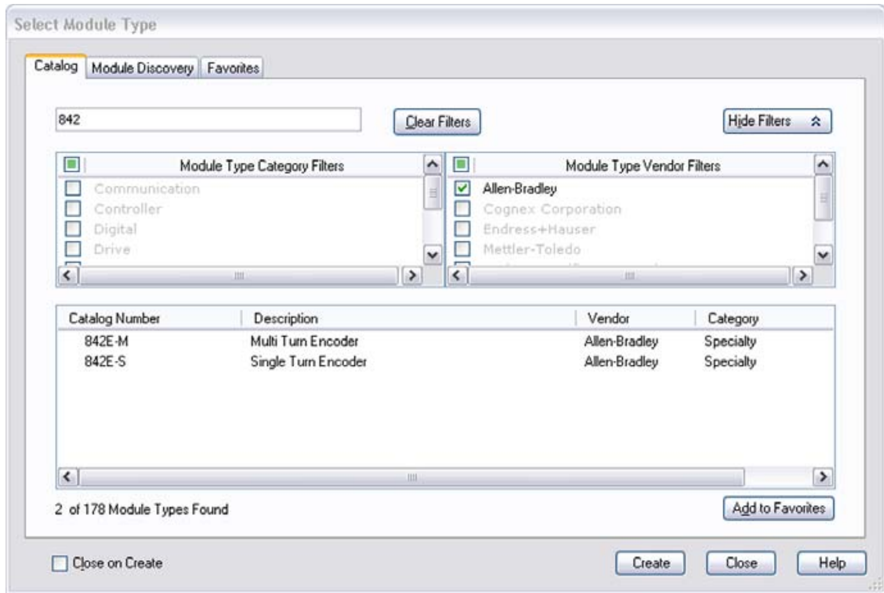
3. Enter the new controller information.



4. Right-click on the ethernet port of the controller and select **New Module.**



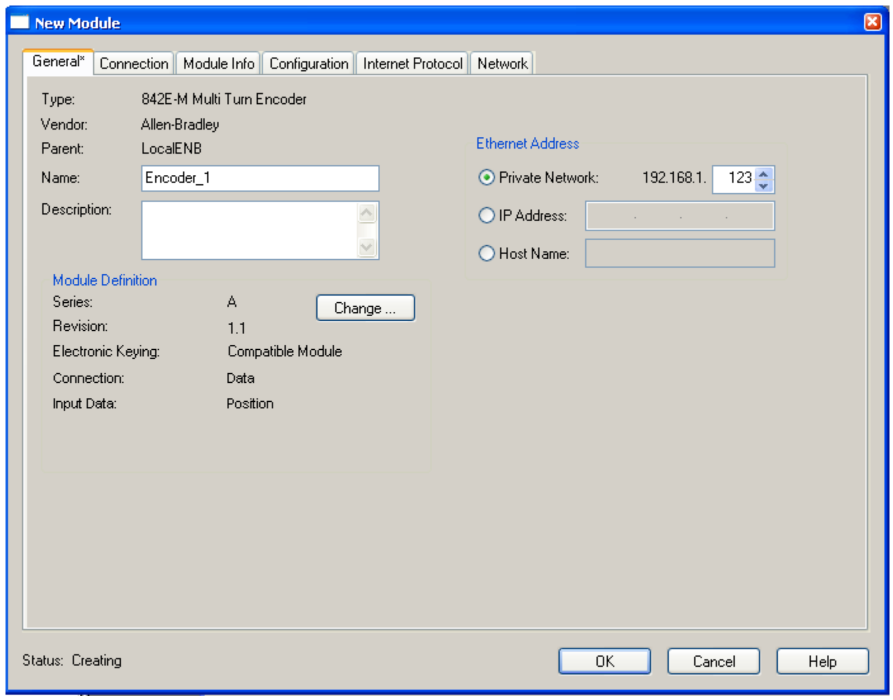
5. Select the desired 842E encoder and click **Create**.



6. Close the select module type dialog box.
7. Continue to the next sections to complete the add-on profile.

General tab

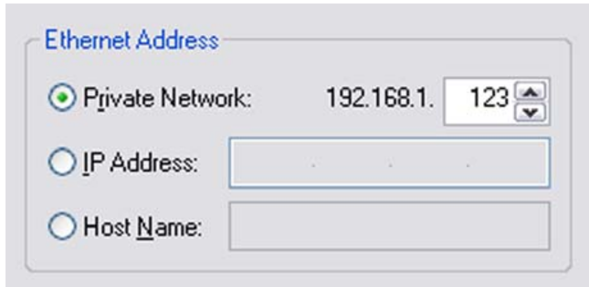
1. Enter a name for the encoder. In this example, the name is *Encoder_1*. You may have multiple encoders or other modules, so be sure to give each a brief but descriptive name. The name that you assign to the encoder appears in the controller organizer IO tree. The name will also appear in the description of tags.
2. Enter a description of the encoder's function.
3. Set the ethernet address for the encoder. In this example, the address is 192.168.1.123. The 123 reflects the address of the network address switches on the 842E.



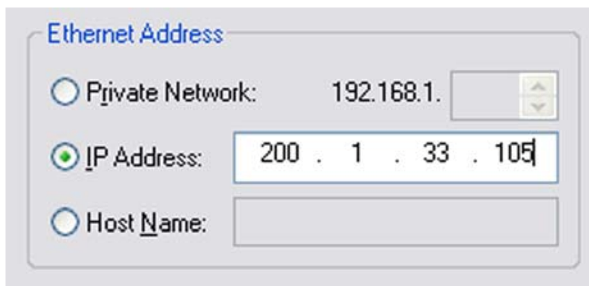
Ethernet address

When the controller is offline, the ethernet address can be set. You have three options:

- When a private network is used, click on the **Private Network** radio button. Enter a value of 1...254 for the last segment (octet) of the address. Be sure not to duplicate the address of an existing device. In the preceding example, the address of the EtherNet/IP encoder is 192.168.1.123.



- When multiple networks exist, you may choose to set the address to some other value. when offline, simply click the IP address radio button and enter the desired address

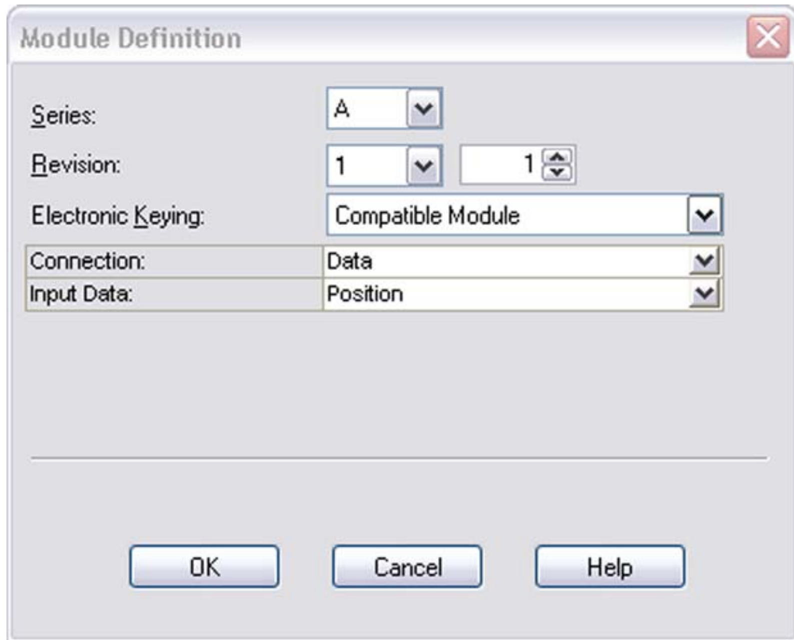


- Click the **Host Name** radio button and type in the name of the host. In the example below, the host name is QPACK4.

Module definition

The user should not have to make changes to the default values. If necessary, follow the steps below to change series, revision, electronic keying, connection, and/or input data.

1. On the **General** tab, click the **Change** button. The module definition window opens.



2. Click the arrows at the right of each box to access drop-down menus.

- The connection drop-down menu allows you to select either a **Data** or **Listen Only** connection (see definitions, below).

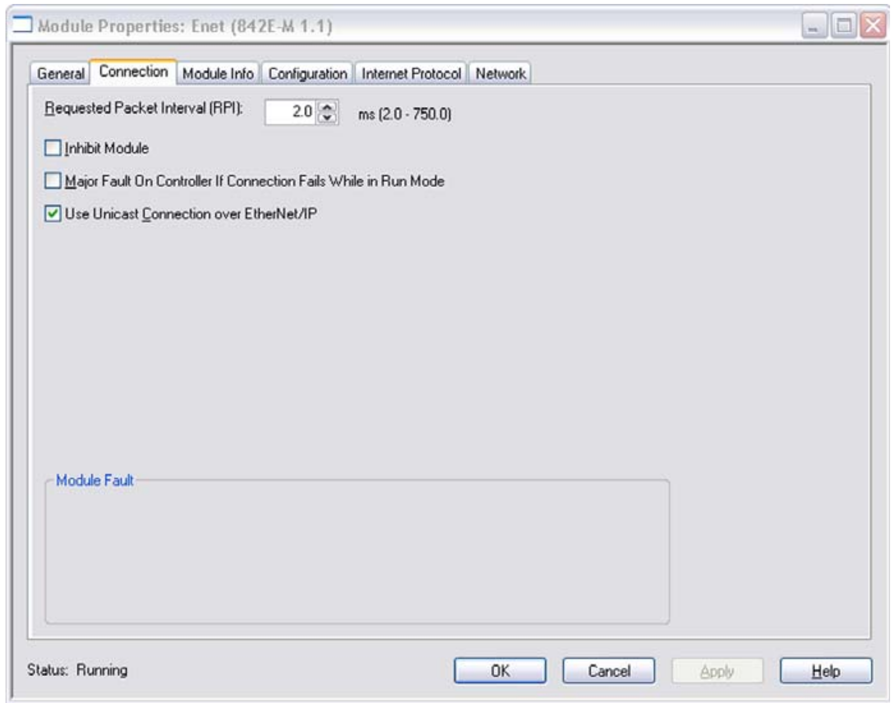
- The Input data drop-down menu allows you to select position, position-status, or position-velocity (see “RSLogix 5000 controller tags” on page 47 for more information).

3. Click **OK** to accept the changes (or **Cancel** to retain the original settings). See the definitions below. Click **Help** for more information.

Data: This type of connection is used to read data from the encoder without controlling the outputs. This connection is not dependent on any other connection.

Listen Only: This type of connection is dependent on another connection to exist. If that connection is closed, the listen-only connection will be closed as well.

Connection tab



You should not have to change any settings on the **Connection** tab. For reference, these are the settings:

Requested Packet Interval: Specify the number of milliseconds between requests for information from the controller to the encoder. The encoder may provide data on a shorter interval, but if no data is received the controller asks the encoder for a status update. Minimum setting is 2 ms and the maximum setting is 750 ms.

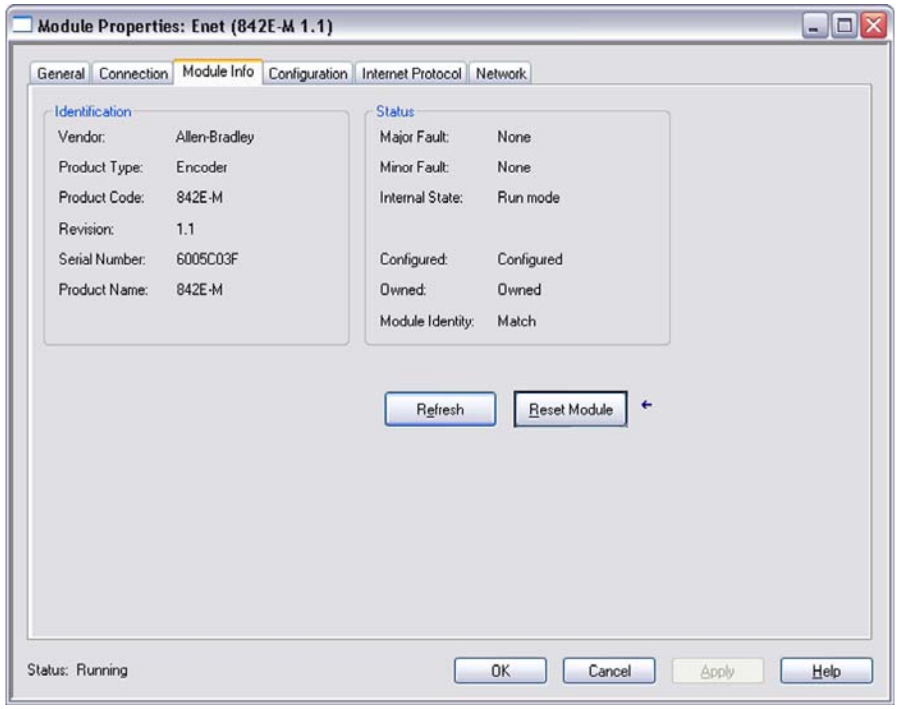
Inhibit Module: When checked, the encoder is not polled for information, and any information provided will be ignored by the controller.

Major fault on controller if connection fails while in run mode: Check this box if a connection failure should be considered a major fault.

Use Unicast Connection over EtherNet/IP: Unicast connections are point to point connections. Multicast connections are considered one to many. Unicast reduces the amount of network bandwidth used.

Module fault: Fault messages will appear in this box.

Module Info tab



The **Module Info** tab contains read-only data that is populated when the controller goes on line (a program is downloaded or uploaded from the controller).

The left panel, **Identification**, shows the vendor, product type, product code, revision level, serial number, and product name.

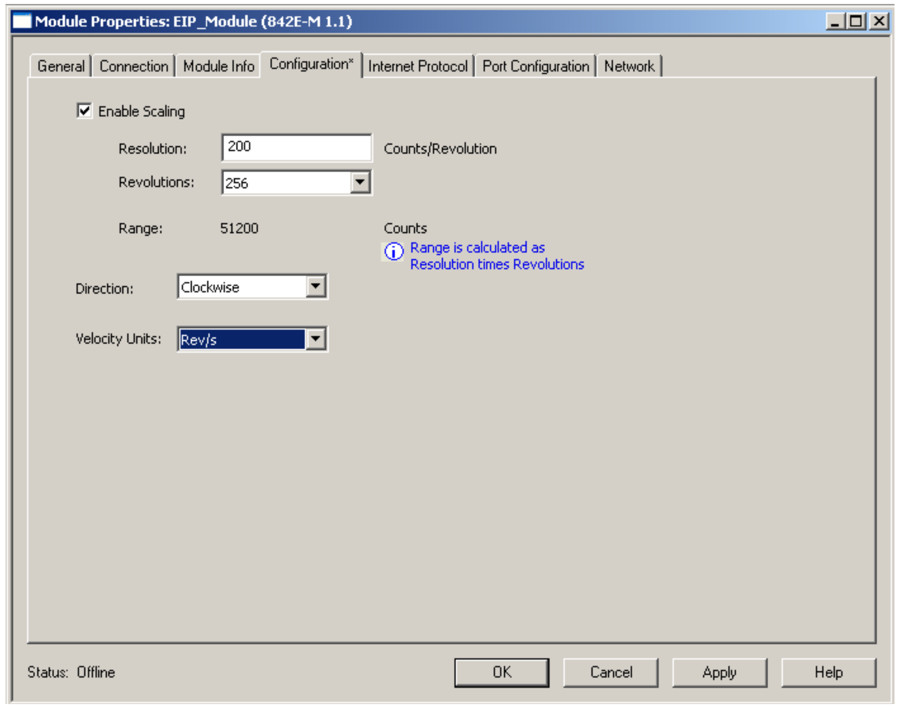
The right panel, **Status,** shows the fault status, internal state (i.e. run mode) and whether the file is owned and **Module Identity**.

The **Refresh** and **Reset Module** buttons are active when the controller is on line.

Refresh: Click this button to refresh the data in the window.

Reset Module: Click this button with care as it disconnects the module momentarily and control will be interrupted. A warning window appears: “Click **Yes** or **No** as needed. Click **Help** for further information.”

Configuration tab



The **Configuration** tab is used to configure the encoder scaling, direction, and set velocity units. Click the **Enable Scaling** checkbox to change the encoder resolution. Use the **Direction** drop down box to set the direction of the encoder (check the definition in the old user manual). Use the velocity units to set the velocity units of the encoder.

Scaling makes it possible to scale the steps per revolution and the total resolution (see "Linear scaling example" on page 59 in Appendix B).

If the **Enable Scaling** box is checked, the values can be entered for the steps per revolution and the total resolution applied.

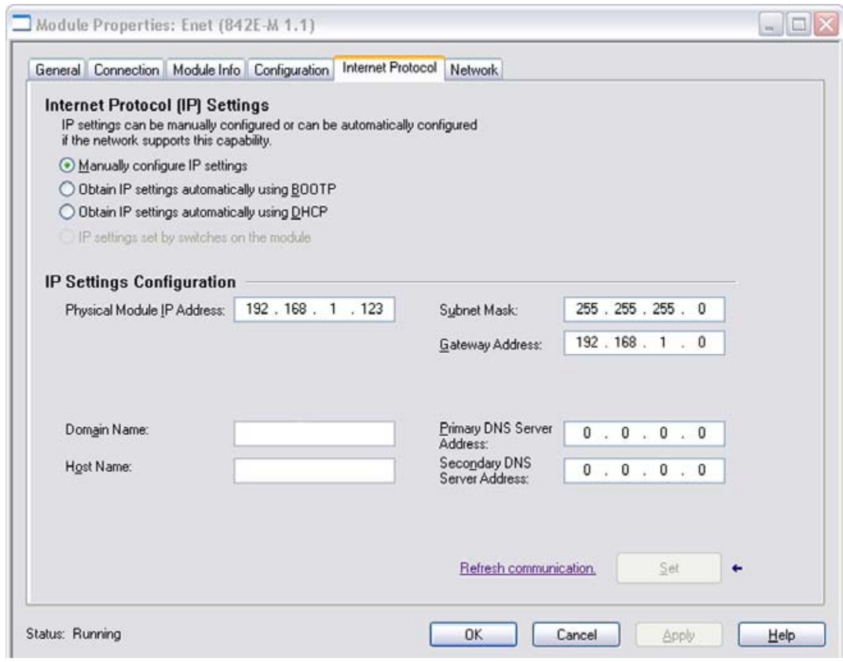
Direction: The direction of rotation (increasing position value), viewed on the shaft, can be set to clockwise or counterclockwise.

- Clockwise = increasing position value on clockwise revolution of the shaft
- Counterclockwise = increasing position value on counterclockwise revolution of the shaft.

Velocity units: Use this parameter to define the units in which the velocity is transmitted. The options are the following:

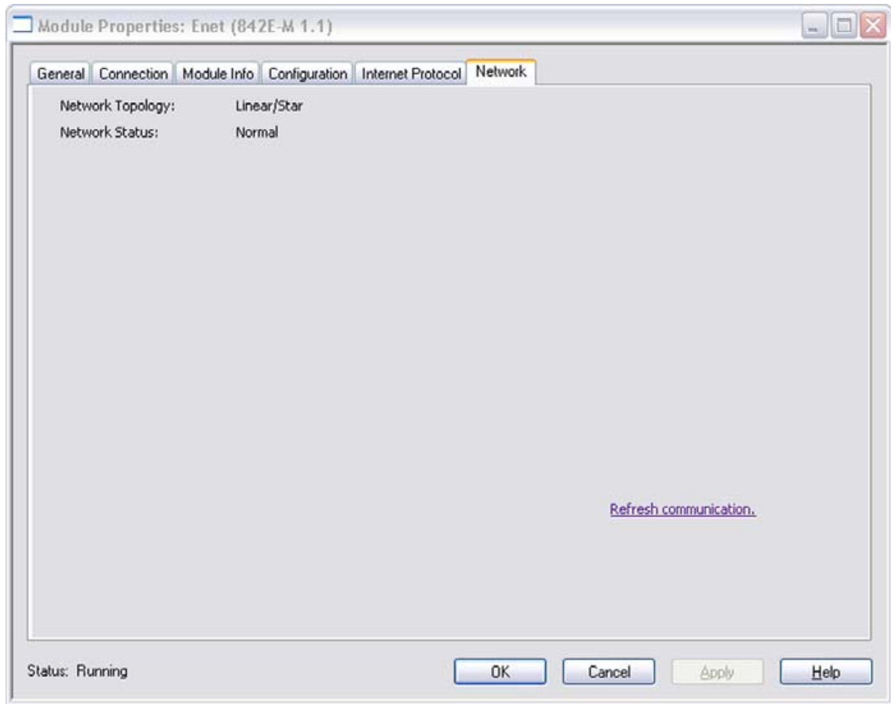
- Counts/sec
- Revolutions/sec
- Revolutions/min

Internet Protocol tab



For the purpose of this user manual, the user is expected to use a private address, that is, an address of 192.168.1.xxx. This window is automatically populated with the data.

Network tab



The **Network** tab contains read-only data that is populated when the controller goes online.

Network Topology: This displays the current network topology as either linear/ star or ring.

Network Status: This displays the current network status as normal, ring fault, or unexpected loop detected.

The **Refresh Communication** link appears when communication with the encoder has failed. Click **Refresh Communication** to attempt to restart communication with the encoder.

Configuration

Default encoder settings

The 842E EtherNet/IP encoder is supplied with the following parameters:

- Direction = clockwise
- Scaling = none
- Steps per revolution = 262,144
- Total resolution = 1,073,741,823
- Preset = 0
- Velocity measuring unit = rpm

Preset function

The 842E encoder position value is set to zero when the preset function is executed (by the preset push button or EtherNet/IP). This predefined value is stored in the EEPROM. The factory default preset value is zero.

ATTENTION	The preset function results in a change of position reading. This can cause unexpected motion which could result in personal injury and damage to the product or equipment. During preset, steps should be taken to ensure the shaft is stationary and will remain so.

The preset function is not intended for use in dynamic parameter setting operations but as an electronic adjustment function during commissioning, in order to allocate a specific value to the mechanical rotary position of the 842E encoder.

If the preset value is set by EtherNet/IP, the value must be within the total working range currently configured (steps per revolution and number of revolutions).

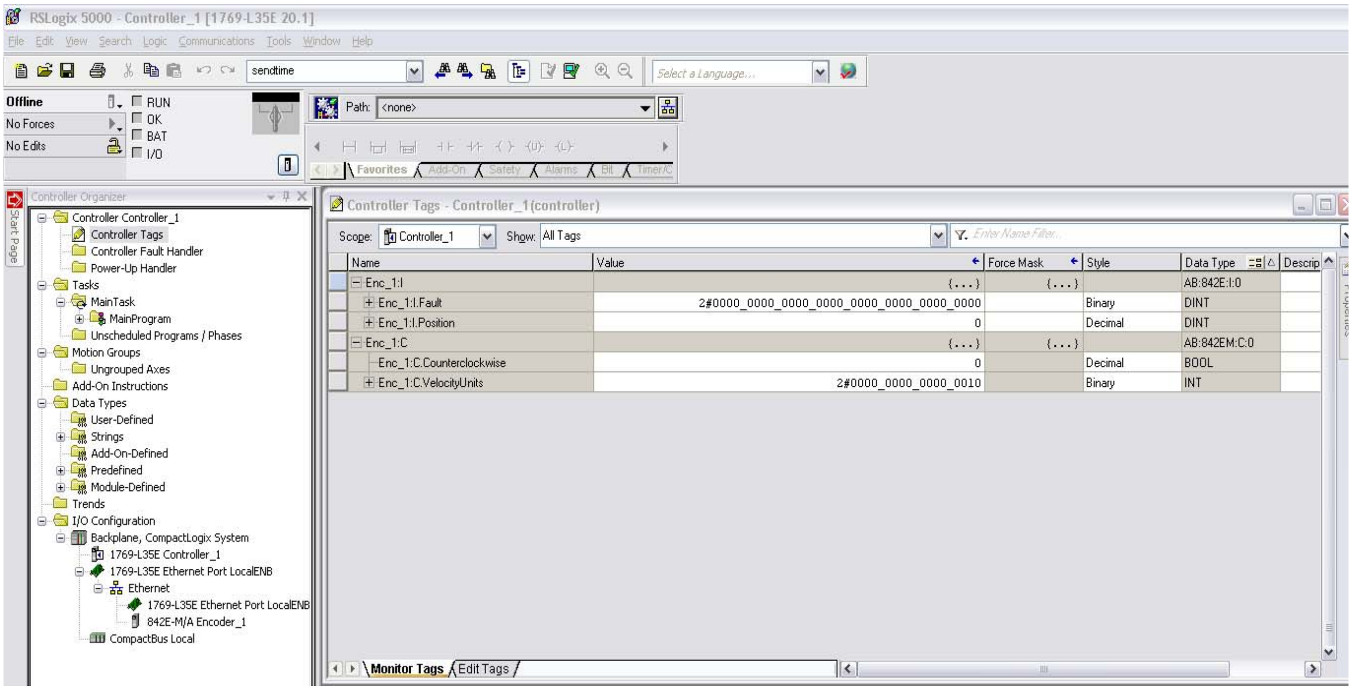
The preset push button (see figure on page 25 and “Preset push button” on page 26) should only be operated when the encoder is powered and the green LED is blinking or steady.

IMPORTANT	Press the preset button briefly, no longer than one second.

RSLogix 5000 controller tags

During the encoder installation the encoder tags are automatically loaded as controller tags. This makes the tags available for all programs.

In the controller organizer, click on the **Controller Tags**.



The categories of tags appear. The tag name is composed of the encoder name followed by a:

- :"C" for configuration
- :"I" for input

Configuration image table and tags

Expand **Enc_1:C by clicking "+."** This shows the configuration image table, which has the following tags:

Name	Value	Force Mask	Style	Data Type	Descrip
+ Enc_1:I	{...}	{...}		AB:842E:I:0	
− Enc_1:C	{...}	{...}		AB:842EM:C:0	
Enc_1:C.Counterclockwise	0		Decimal	BOOL	
+ Enc_1:C.VelocityUnits	2#0000_0000_0000_0010		Binary	INT	

Enc_1:C.Counterclockwise: Configuration status of the direction of the count as defined in the encoder profile.

Enc_1:C.VelocityUnits: Velocity units status of the encoder as defined in the encoder profile.

Input image table and tags

Expand **Enc_1:I** by clicking "+." This shows the input image table, which has the following tags:

Name	Value	Force Mask	Style	Data Type	Descrip
Enc_1:I	{...}	{...}		AB:842E_Status:I:0	
Enc_1:I.Fault	2#0000_0000_0000_0000_0000_0000_0000_0000		Binary	DINT	
Enc_1:I.Position	246706810		Decimal	DINT	
Enc_1:I.Alarm	0		Decimal	BOOL	
Enc_1:I.Warning	0		Decimal	BOOL	
Enc_1:C	{...}	{...}		AB:842EM:C:0	

Enc_1:I.Fault: Fault status of the encoder.

Enc_1:I.Position: Position status of the encoder. If position-status is selected from the input data selection in the encoder definition you will also see alarms and warning status.

Enc_1:I.Velocity: Velocity status of the encoder is also included when selecting velocity-status from input data selection in the encoder definition.

Diagnostics and troubleshooting

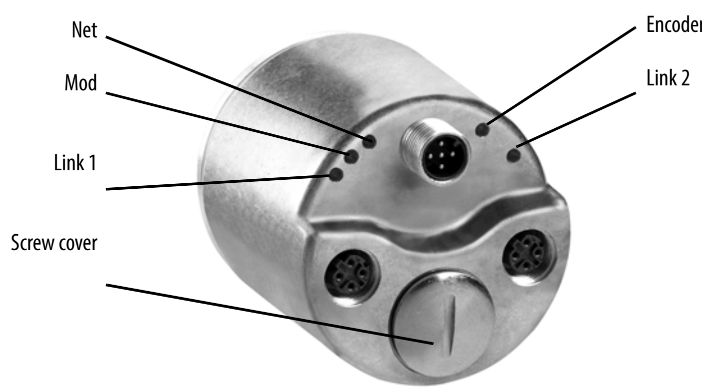
This chapter describes the diagnostic process to correct and clear fault conditions on the 842E encoder.

ATTENTION	Cease operation if the cause of the malfunction has not been identified! Stop the machine if you cannot clearly identify the error and/or if you cannot safely rectify the malfunction.

Status indicators

The **Mod** LED shows the device status, the **Net** LED shows the status of the CIP connection, and the **Encoder** LED shows the status of the internal measuring device in the 842E EtherNet/IP encoder.

Five LED indicators provide status information on the back of the encoder. The figure below shows their location and the tables below describe their status.



Read the LEDs according to the following tables.

LED Net	Description
OFF	No power or No IP address
Green flashing	No connection The device has an IP address but no CIP connection.
Green	The device has an IP address and a CIP connection.

LED Net	Description
Red flashing	Warning, connection time-out Cleared by reset or a new connection
Red	Error IP address has been assigned to another device already.
Green/Red flash	Self-test at power-on

LED Mod	Description
OFF	No power
Green	Device operational
Green flashing	Standby/device not configured, no IP address assigned
Red flashing	Warning, but device still operational or Firmware update in progress
Red	Error, device not operational
Green/red flashing	Self-test at power-on

LED Encoder	Description
OFF	No power or No IP address
Green flashing	Warning Wrong parameter
Green	Device operational
Red flashing	Warning, but device still operational or Firmware update in progress
Red	Error Encoder error
Green / red flashing	Self-test at power-on

Ethernet Link LEDs Link 1 and 2

The ethernet link LEDs, **Link 1** and **Link 2,** display the status of the physical connection on the ethernet interface.

Link 1 or Link 2 LED	Description
OFF	No link / power off
Green solid	Ethernet connection established
Green flashing	Data transmission TxD/RxD
Amber solid	Interface port locked
Amber flashing	Data collisions

Self-test via EtherNet/IP

Electromagnetic interference (EMI) can cause incorrect operations or errors in the position value. Without a self-test an immediate position change may occur on power up.

Using the position sensor object a self-test can be triggered with attribute 13. See “CIP object model” on page 17. During this test the sensor and the most important functions are tested automatically. If an error occurs, bit 27 in the fault header is set.

Warnings, alarms and errors via EtherNet/IP

ATTENTION	It is imperative to evaluate the alarms in your application! In case of a serious error, incorrect position values may be output. This change could cause an unexpected movement that may result in a hazard for persons or damage to the system or other objects.

Within EtherNet/IP warnings, alarms, and errors can be retrieved using implicit messages and also explicit messages.

Alarms and warnings for the encoder can be read via the position sensor object with the aid of the attributes.

For errors, alarms, and warning the following applies:

Bit status = 0: no error, alarm or warning

Bit status =1: error, alarm or warning present

In addition the **Net** LED illuminates red continuously.

Warnings

Supported warnings (attribute 47+48)

Bit	Warning	Description	FALSE (0) (47)	TRUE (1) (47)
0	Frequency exceeded	Max. velocity exceeded	OK	Exceeded
1	Light control reserve	LED current critical	OK	Out of range
2	CPU watchdog	Not implemented	Always 0	–
3	Operating time limit warning	Operating time limit reached	Always 0	–
4	Battery charge	Not implemented	Always 0	–
5	Reference point	Not implemented	Always 0	–
6	Minimum velocity flag	Minimum velocity set-point reached	OK	Fall below
7	Maximum velocity flag	Maximum velocity set-point reached	OK	Exceeded
8	Minimum acceleration flag	Minimum acceleration set-point reached	OK	Fall below
9	Maximum acceleration flag	Maximum acceleration set-point reached	OK	Exceeded
10	Position limits exceeded	Max. position exceeded	OK	Exceeded
11	Reserved by CIP	–	Always 0	–
12	Reserved by CIP	–	Always 0	–
13	Vendor: Temperature out of range	Temperature set-points reached	OK	Out of range
14	Vendor: over / under voltage (9.700…30.300mV)	voltage set-points reached	OK	Out of range

Alarms

The alarm type is coded in a bit field of attributes 44 and 45. If one of the bits is listed below is set, the alarm flag (attribute 47) will also be set.

If, for example, the velocity or temperature drop below/exceed the limit values, the warning flag is set (attribute 49 position sensor object).

In addition, the **Net** LED flashes red.

The warning type is coded in a bit field of attributes 47 and 48.

Note: The position value will continue to be correctly calculated; the encoder is therefore still ready for operation.

Supported alarms (attribute 44+45)

Bit	Description	Description	FALSE (0) (44)	TRUE (1) (44)
0	Position ERROR	Position error	Ok	ERROR
1	Diagnostic ERROR	Diagnostic error	Ok	ERROR
2…11	Reserved by CIP	–	–	–
12	Vendor: checksum ERROR	Checksum error	Ok	ERROR
13	Vendor: startup ERROR	Startup error	Ok	ERROR
14…15	Vendor specific	–	–	–

Errors

Sensor error table

Fault header [byte]	Bit	Error	Description	FALSE (0)	TRUE (1)	Supported	Warning/ alarm
0	0	Reserved	Reserved	Always 0	–	NO	W
	1	Over temperature sensor	Operating temperature of the encoder outside the permissible range	0	1	YES	W
	2	Light control reserve	Permissible internal LED current in the sensors exceeded	0	1	YES	W
	3	Voltage detection	Supply voltage outside the permissible range	0	1	YES	W
	4	Frequency exceeded	Frequency error, maximum velocity has been exceeded.	0	1	YES	W
	5	Velocity exceeded	The velocity has dropped below/ exceeded the minimum/maximum velocity configured with attribute 27 or 28.	0	1	YES	W
	6	Acceleration exceeded	The acceleration has dropped below/ exceeded the minimum/ maximum acceleration configured with attribute 32 or 33.	0	1	YES	W
	7	Position limits exceeded	The position has dropped below/ exceeded the minimum/maximum position configured with attribute 22 or 23.			YES	W
1	8	Position error	Position error (amplitude error of the single-turn measurement)	0	1	YES	A
	9	Position error	Position error (amplitude error of the multi-turn measurement)	0	1	YES	A
	10	Position error	Position error (vector error $Sin^2 + Cos^2$ of the single-turn measurement)	0	1	YES	A
	11	Position error	Position error (vector error $Sin^2 + Cos^2$ of the multi-turn measurement)	0	1	YES	A
	12…15	Reserved	Reserved	Always 0		NO	–
	16	Position error	Single-turn position error (error in the sensor)	0	1	YES	A

Fault header [byte]	Bit	Error	Description	FALSE (0)	TRUE (1)	Supported	Warning/ alarm
2	17	Position error	Multi-turn position error (synchronization MA single)	0	1	YES	A
	18	Position error	Multi-turn position error (synchronization quad single)	0	1	YES	A
	19	Position error	Multi-turn position error (internal interface)	0	1	YES	A
	20	Position error	Multi-turn position error (FRAM)	Always 0	–	NO	A
	21…23	Reserved	Reserved	Always 0		NO	–
3	24	Position or memory error	Memory error (EEPROM checksum)	0	1	YES	A
	25	Memory error	Memory error (EEPROM IRQ)	0	1	YES	A
	26	Startup error	Error on start-up	0	1	YES	A
	27	Diagnostic error	Error during self-test	0	1	YES	A
	28…29	Reserved	Reserved				
	30	Slave sign of life	LifeSign; active if attribute 13 is set	0	1	YES	–
	31	Reserved	Reserved	Always 0		NO	–

Installing the add-on profile

Introduction

This appendix shows how to install the add-on profile (AOP) of the encoder with the RSLogix 5000 program. Add-on profiles are files that users add to their Rockwell Automation library. These files contain the pertinent information for configuring a device that will be added to the Rockwell Automation network.

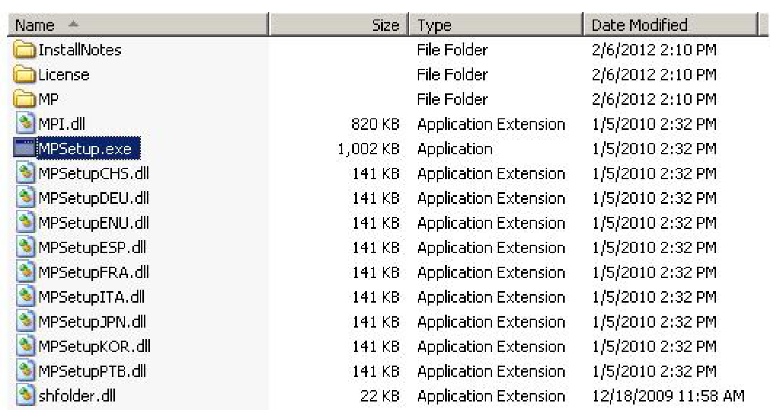
The add-on profile simplifies the setup of devices because it presents the necessary fields in an organized fashion, which allows users to set up and configure their systems in a quick and efficient manner.

The add-on profile is a folder containing numerous files for the device. It will come as an installation package.

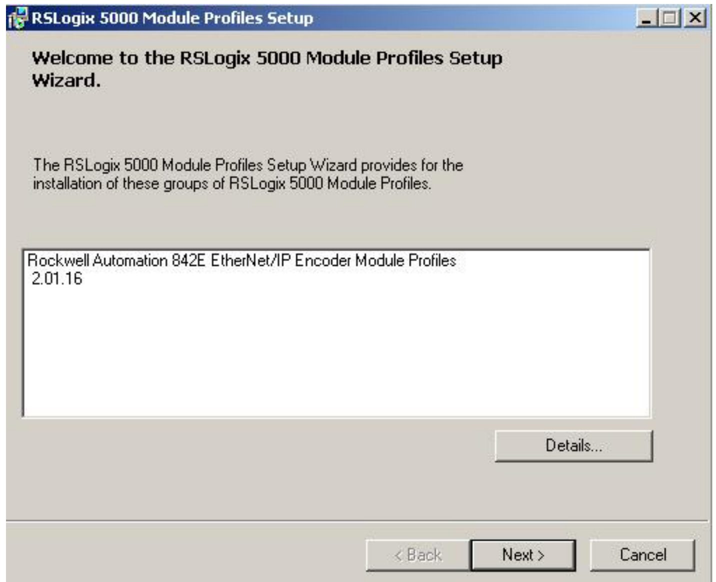
Performing the installation

Install the add-on profile following the on-screen instructions.

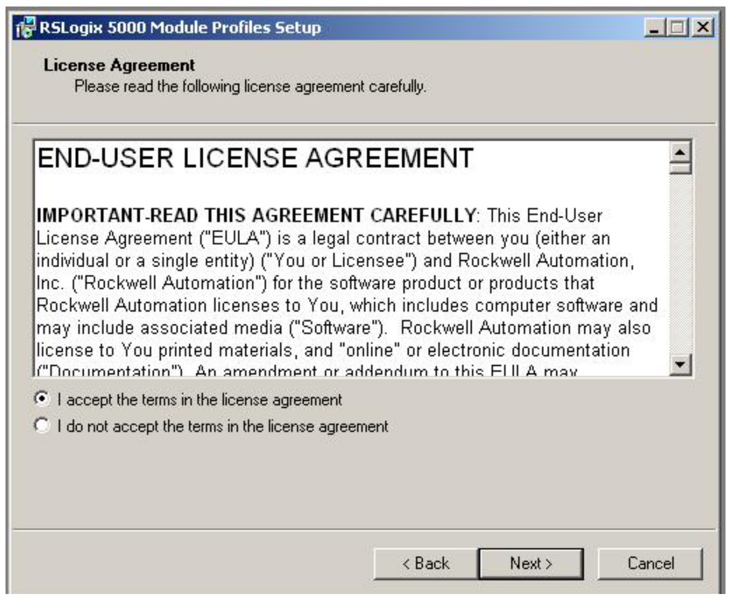
1. In the file explorer, locate the directory where the installation files were extracted.
2. Click **MPSetup.exe**.
3. Extract the zip file to a local directory on you computer.
4. Double-click on **MPSetup.exe** to begin the installation.



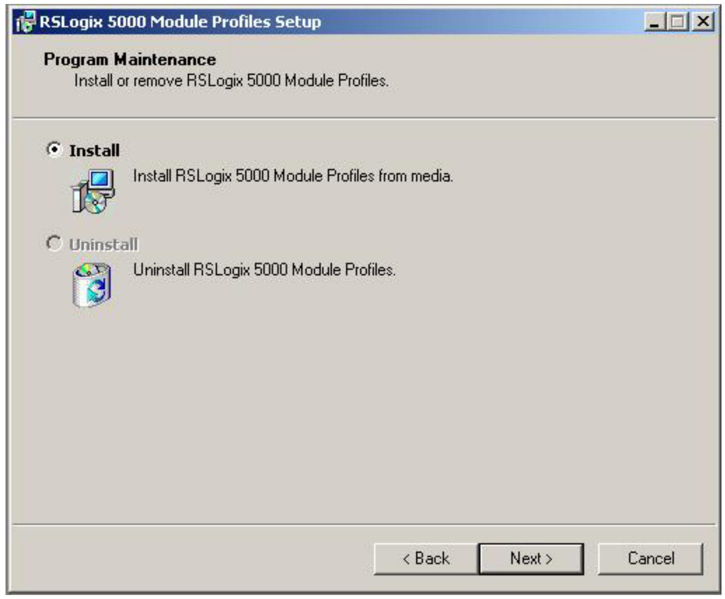
5. At the welcome screen click on **Next**.



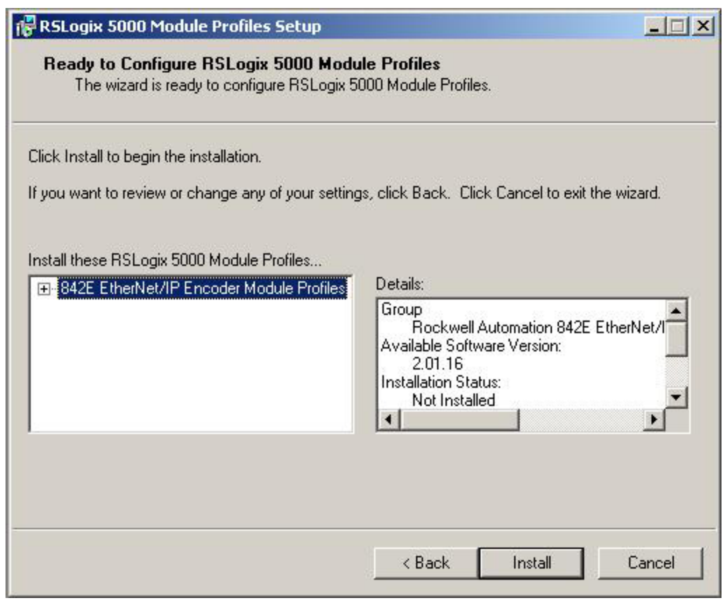
6. Click the radio button to accept the licensing terms, then click **Next**.



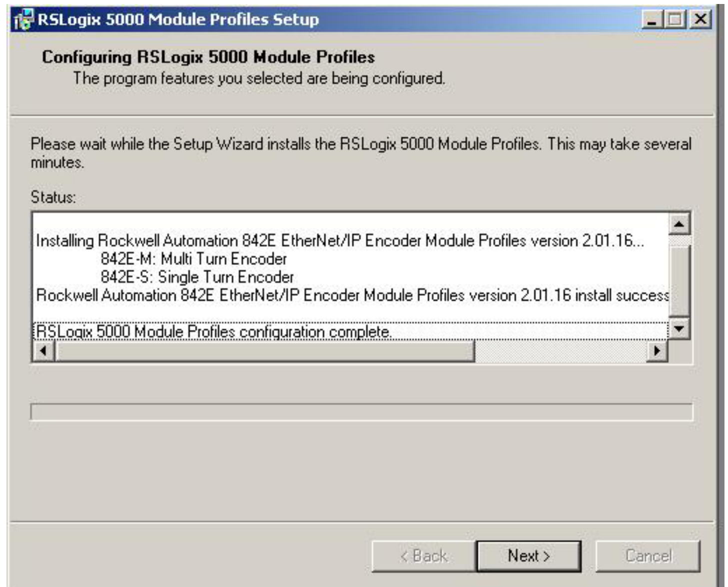
7. Click the **Install** radio button and then click **Next**.



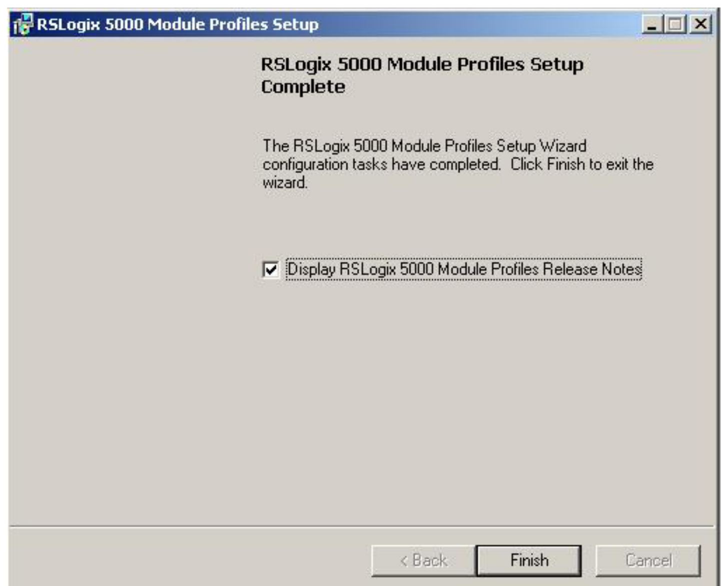
8. Click **Install** to begin the installation.



9. Click **Next** to install the add-on profile files.



10. Click **Finish** to complete the installation.



RSLogix 5000 sample code

This appendix gives examples of using your encoder, including how to use RSLogix 5000 to set and read parameters.

- “Linear scaling example,” next section
- “Setting up your project” on page 60
- “Using an explicit message configuration to set preset encoder value” on page 65
- “Using an explicit message configuration to read preset encoder value” on page 69
- “Using an explicit message configuration to obtain the encoder’s run-time in seconds” on page 73

Linear scaling example

A linear cart is to be controlled using ball screw slide. The cart will stop after 1 m of travel for loading and unloading. For precise measurement of the distance between stops, 10,000 steps are required.

The cart will travel 20 mm for one revolution of the encoder, bringing the number of rotations the encoder turns for 1m of travel distance to 50. For a resolution of 10,000 steps per meter, the encoder requires 200 steps per revolution.

There are three (3) stops along the 3-m track, so our total resolution must be at least 3 x 10,000 = 30,000 steps to cover the length of the track. For the scaling function, our total resolution must be

$$2^n \text{ x CPR}$$

or in this case

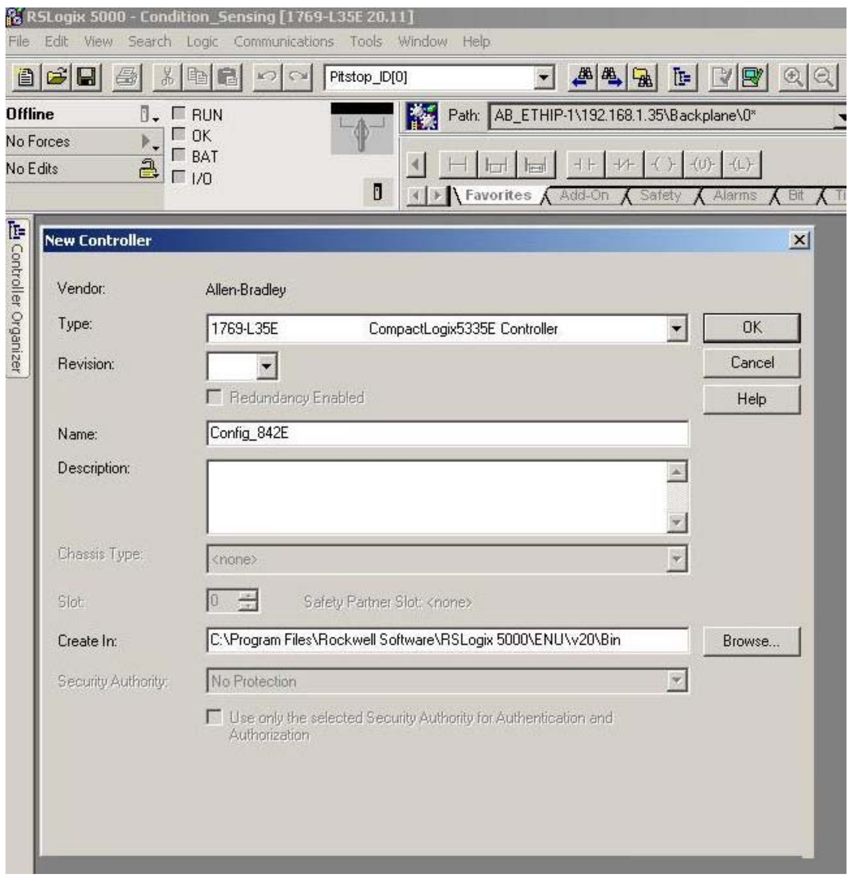
$$2^8 \text{ x } 200 = 51{,}200$$

Set up the Configuration tab as follows.

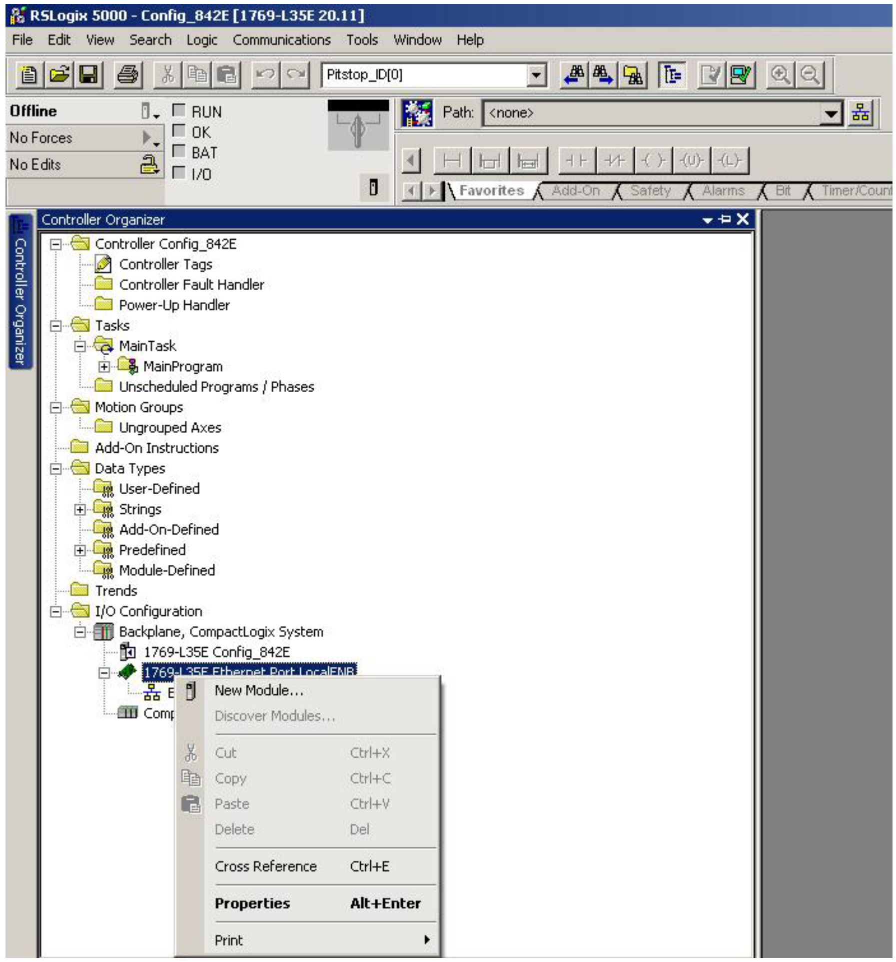
1. Set **Parameter Scaling** to **Enable.**
2. Set **Counts per Revolution** to 200.
3. **Total Measuring Range** will be 51,200.
4. Position the slide/encoder to a known start position.
5. Set the preset value. The preset value will be retained by the encoder through a machine cycle.

Setting up your project

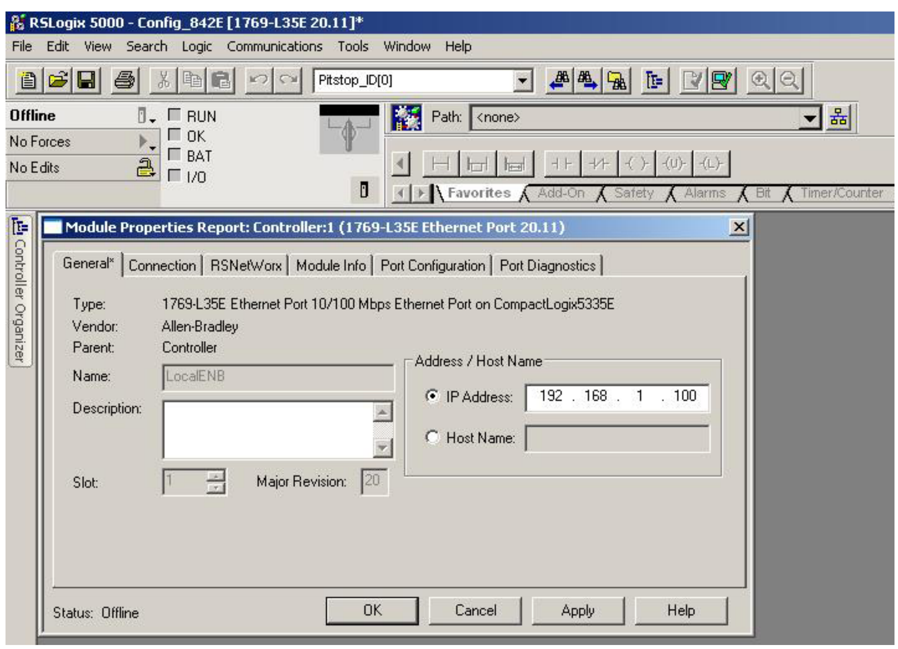
1. Create a new program file. Select the processor revision and name the project file. In this example the CompactLogix 1769-L35E V20 was used.



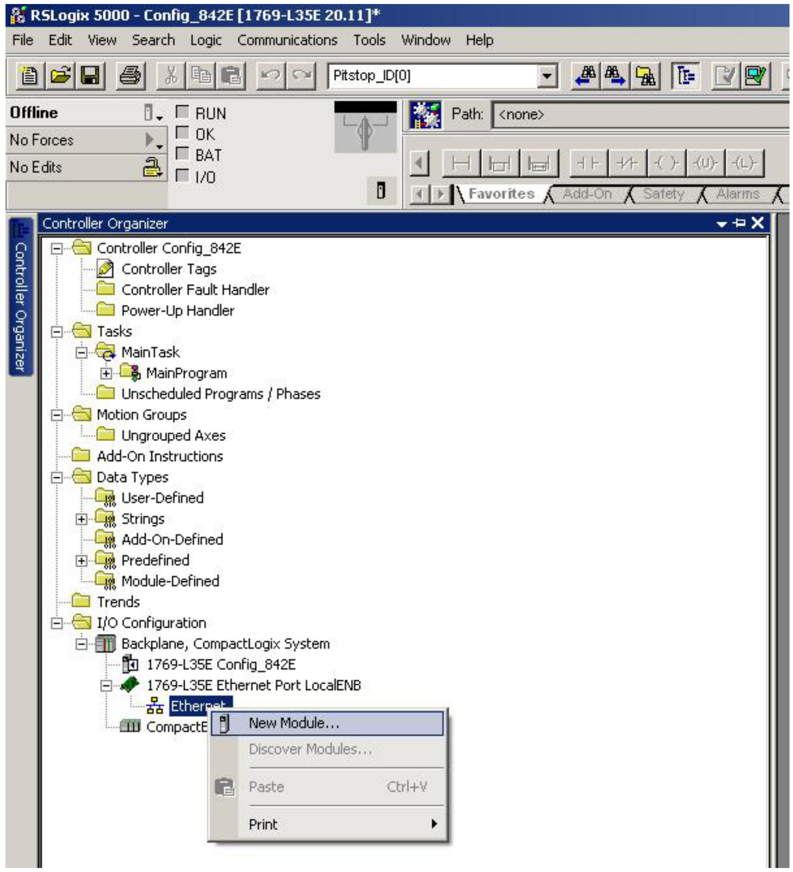
2. In the controller organizer, right-click **Ethernet Communication Adapter** and select **Properties**.



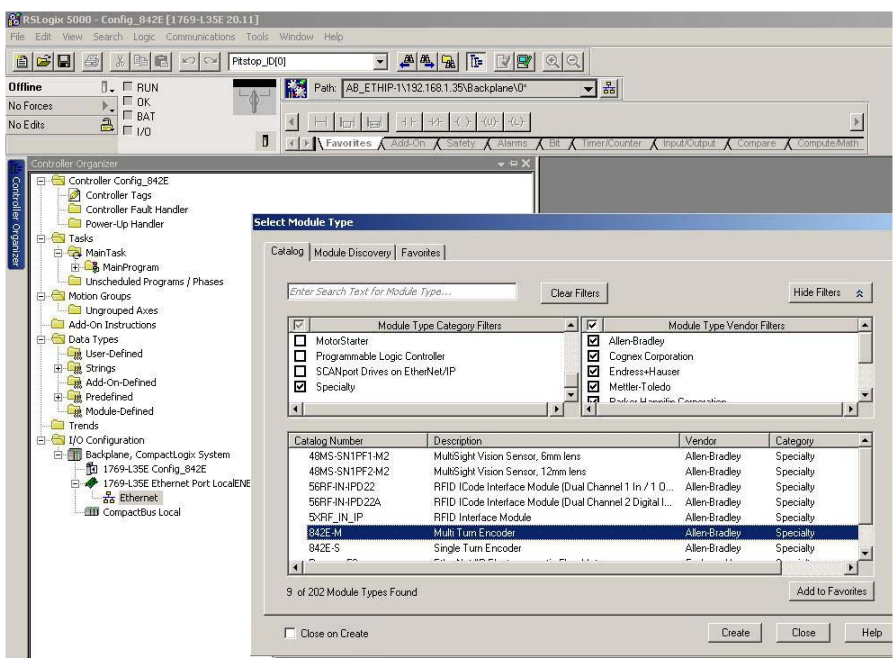
3. Configure the controller's IP address, this example uses 192.168.1.100. Click **Apply**, then **OK**.



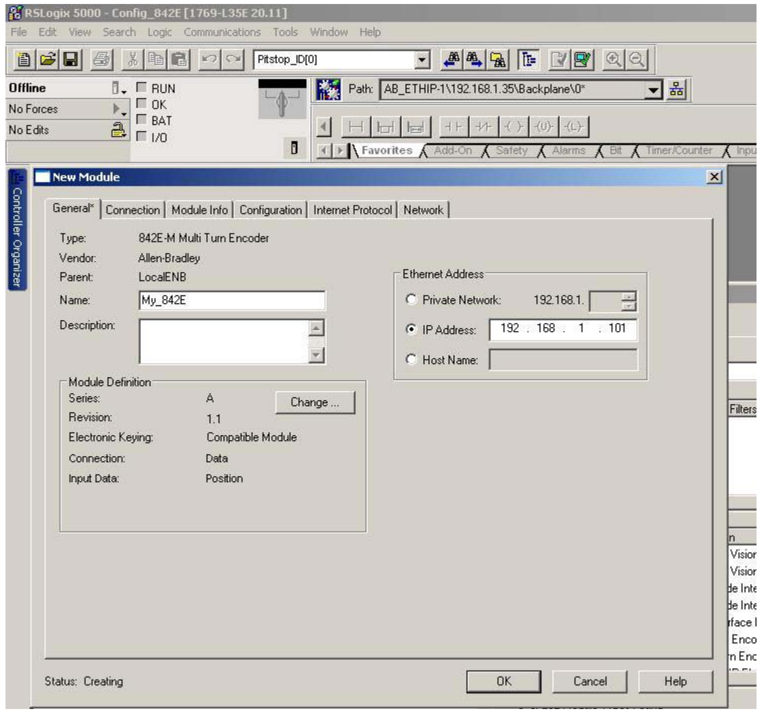
4. Right-click **Ethernet Network** and select **New Module**.



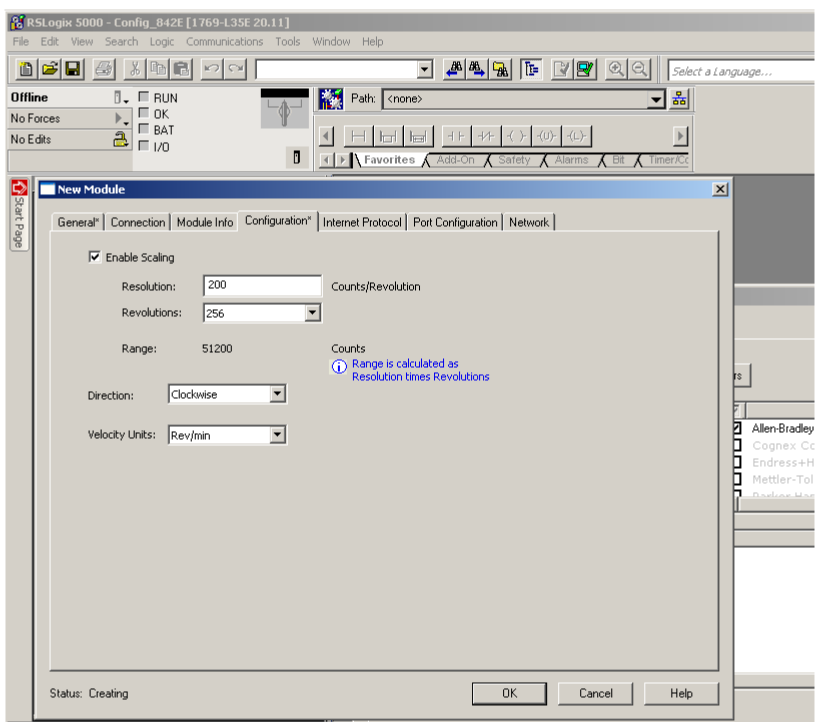
5. Find the encoder add-on profiles under specialty modules. Select the add-on profile for either **Multi-turn Encoder** or **Single-turn Encoder**, then click **Create**.



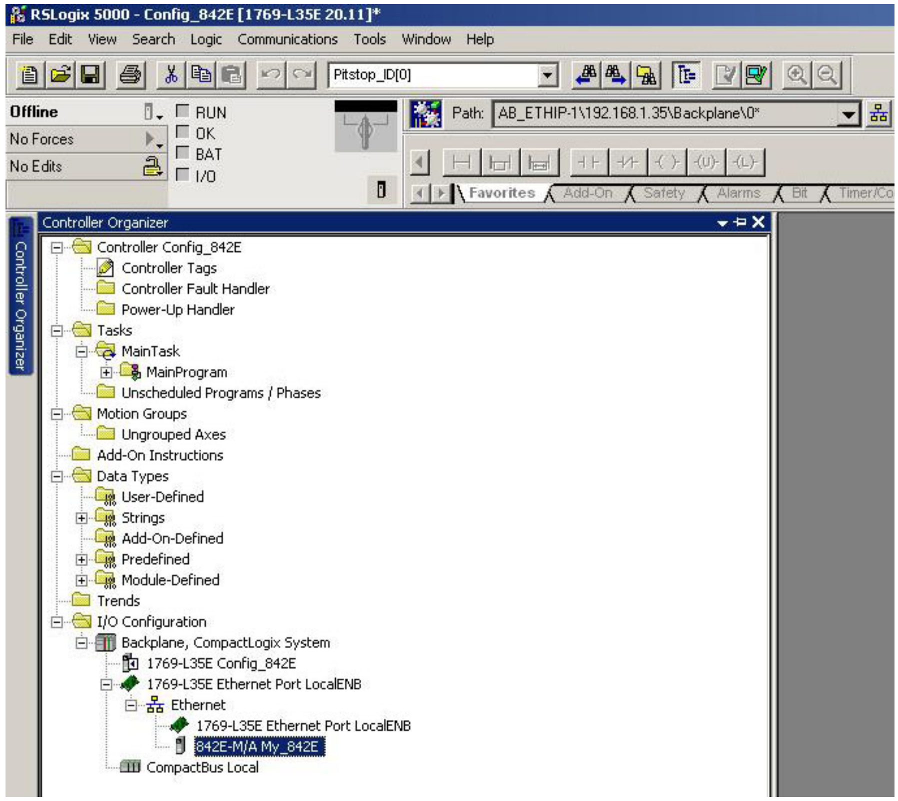
6. The encoder add-on profile configuration will then launch. Name the encoder (In this example it is *My_842E)*. Configure the encoder's IP address at 192.168.1.101.



7. Click the Configuration tab and set it up as shown per the linear scaling example on page 59. Click **Apply**, then **OK**.



8. The encoder can now be seen as configured on the ethernet network in the controller organizer.



9. The project can then be downloaded to the controller.

Using an explicit message configuration to set preset encoder value

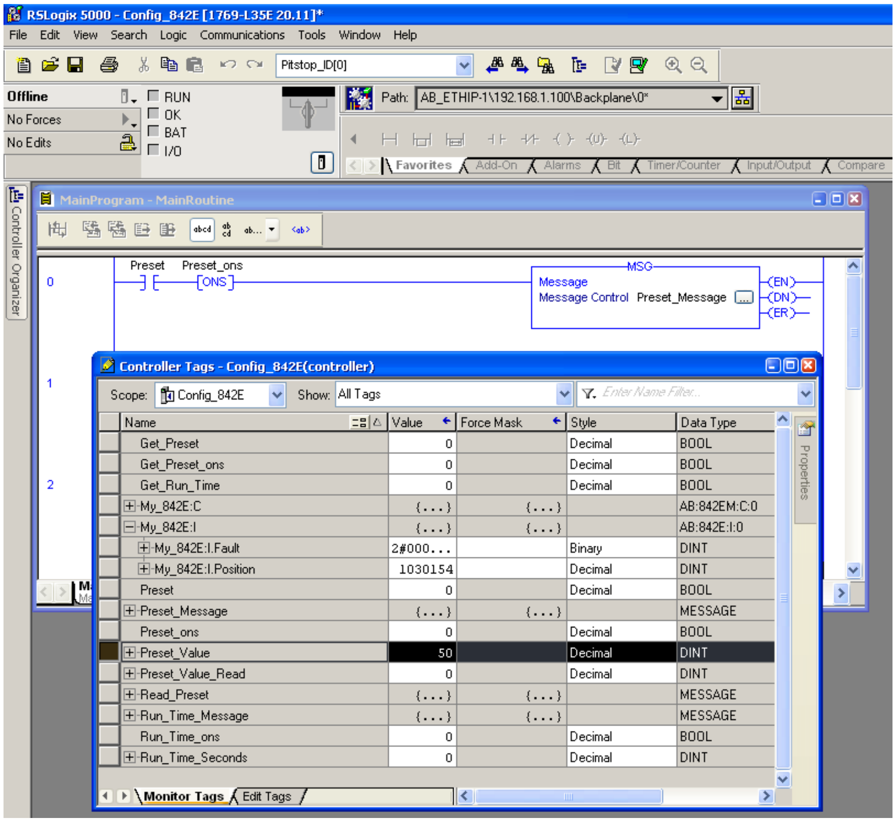
ATTENTION	The preset function results in a change of position reading. This can cause unexpected motion which could result in personal injury and damage to the product or equipment. During preset, steps should be taken to ensure the shaft is stationary and will remain so.

ATTENTION	In this example, a value is sent to the preset attribute in the encoder. The encoder stores this preset value in non-volatile memory. Storing the preset value applies the preset value to the encoder position value.

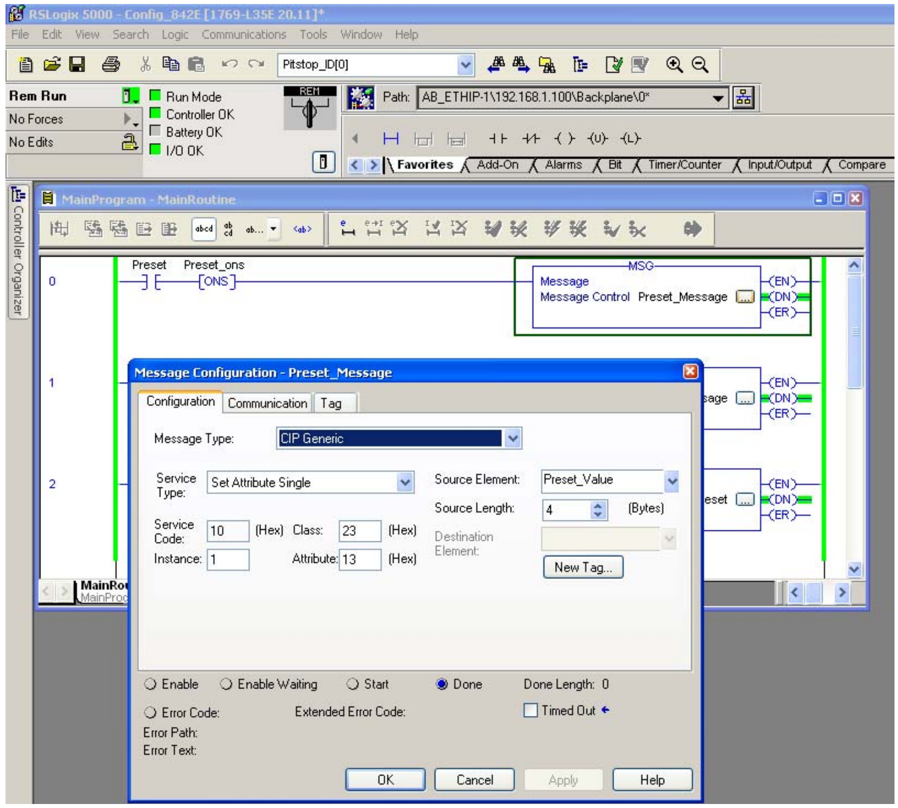
In this example a value is sent to the preset attribute in the encoder. The encoder stores the preset value sent in non-volatile memory. Storing the preset value applies the preset value to the encoder position value.

The following program fragment sends an explicit message and confirms the message reception.

1. Create a new message data type named *Preset_Message* and a DINT named *Preset_Value*.



2. Add a new MSG instruction to the program and browse to the **Preset_Message** data type created in step 1. Then double-click the gray box on the message instruction to configure it.



3. Use the Position Sensor Object to find the values you want to use to send an explicit message. In the Configuration tab select:

   Message type: CIP generic

   Service type: Set attribute single

   Service code: (Automatically populated)

   Source element: Preset_value (browse to this tag).

   Source length: 4

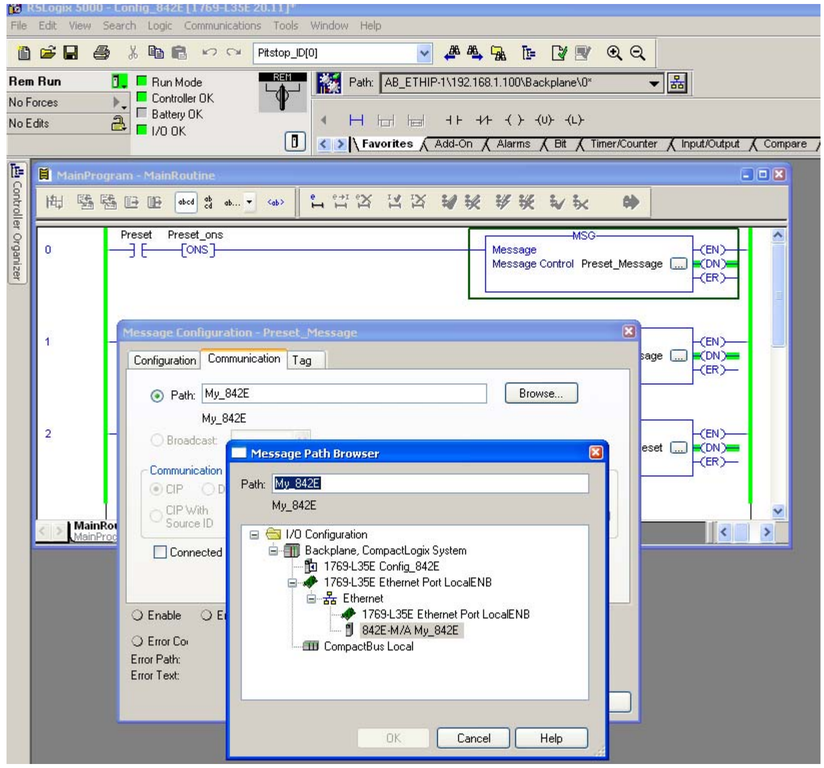
   Instance: 1

   Class: 23*

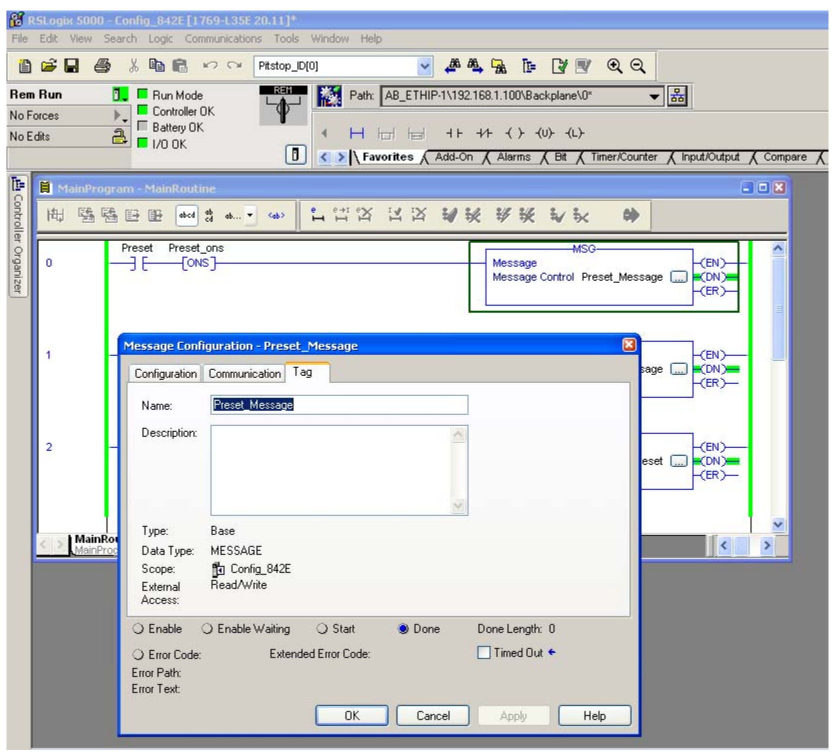
   Attribute: 13*

   *hexadecimal values

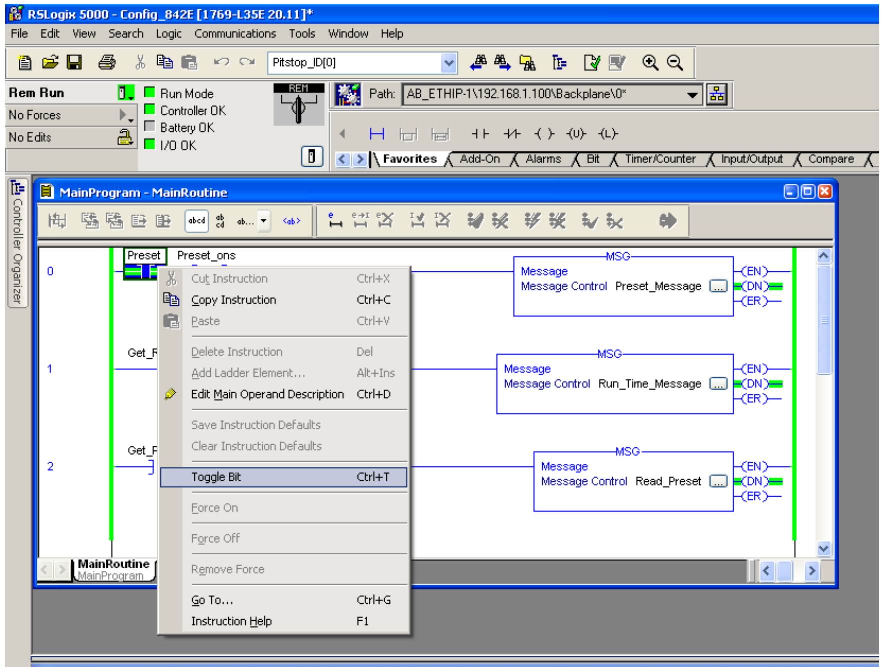
4. In the **Communication** tab, browse to the encoder on the ethernet network, then click **OK**.



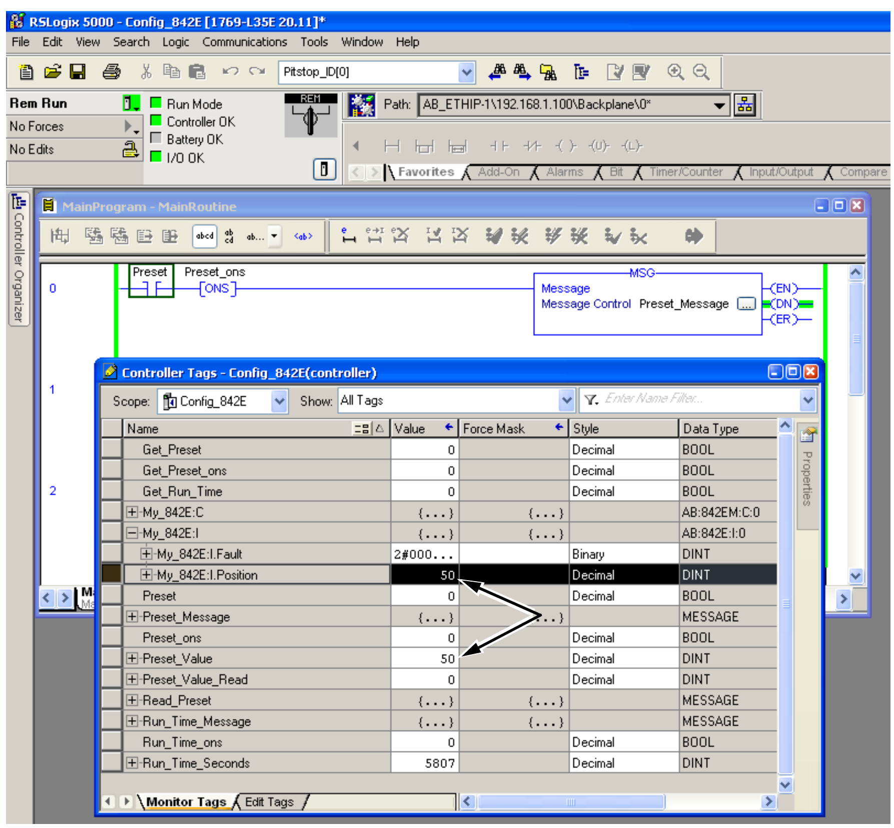
5. The **Tag** tab will be populated for the **Preset_Message**



6. Add a normally open contact and a one-shot instruction to initialize the message instruction.



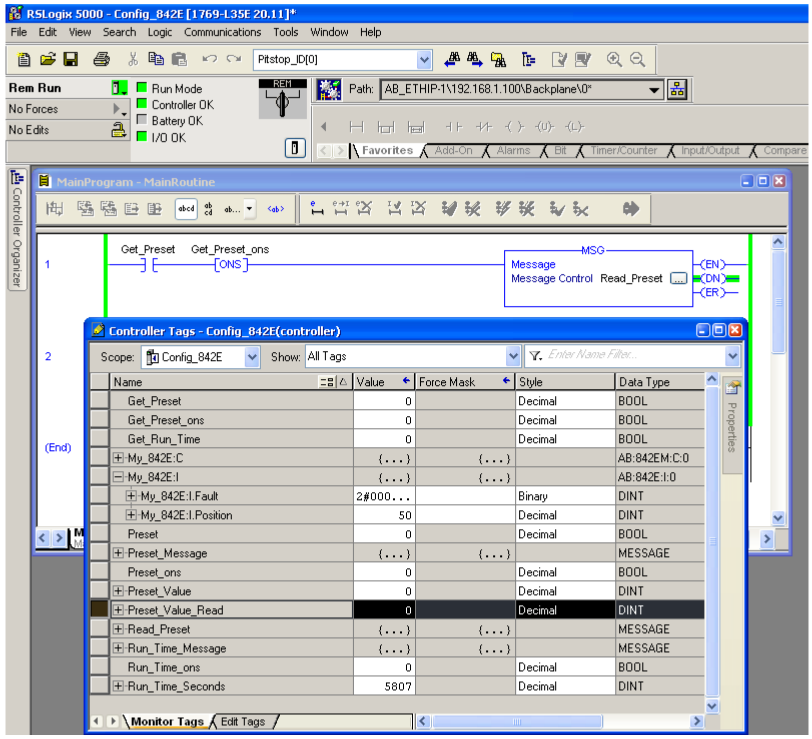
7. After you enter a value into the **Preset_Value DINT** and toggle the preset contact, the message instruction presets the encoder's current count value. The position value is changed to the preset value you set.



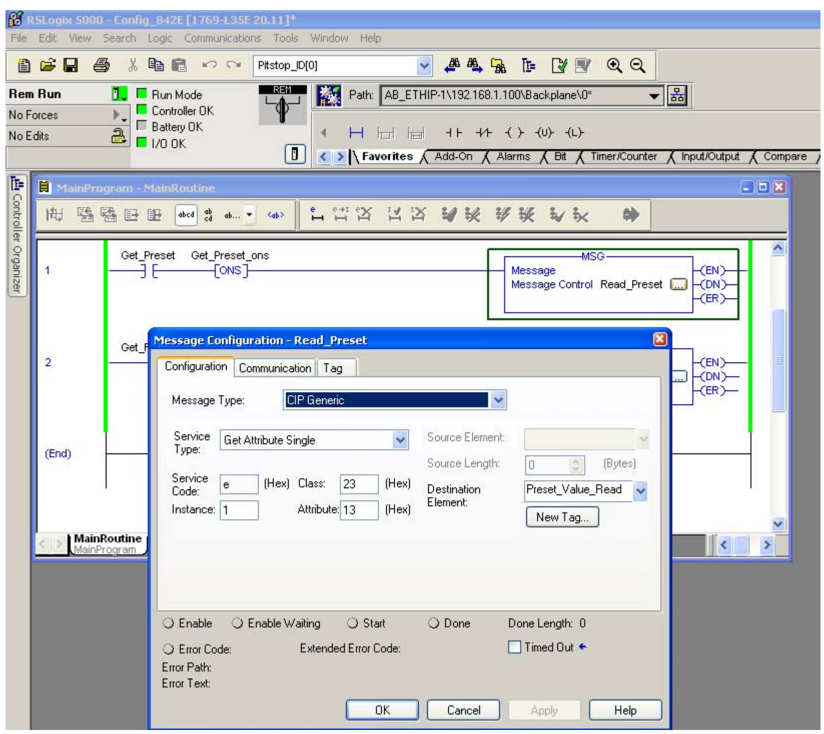
IMPORTANT	Always do a *Get* after a *Set* to verify the value was changed.

Using an explicit message configuration to read preset encoder value

1. Create a new message data type named Read_Preset and a DINT named Preset_Value_Read.



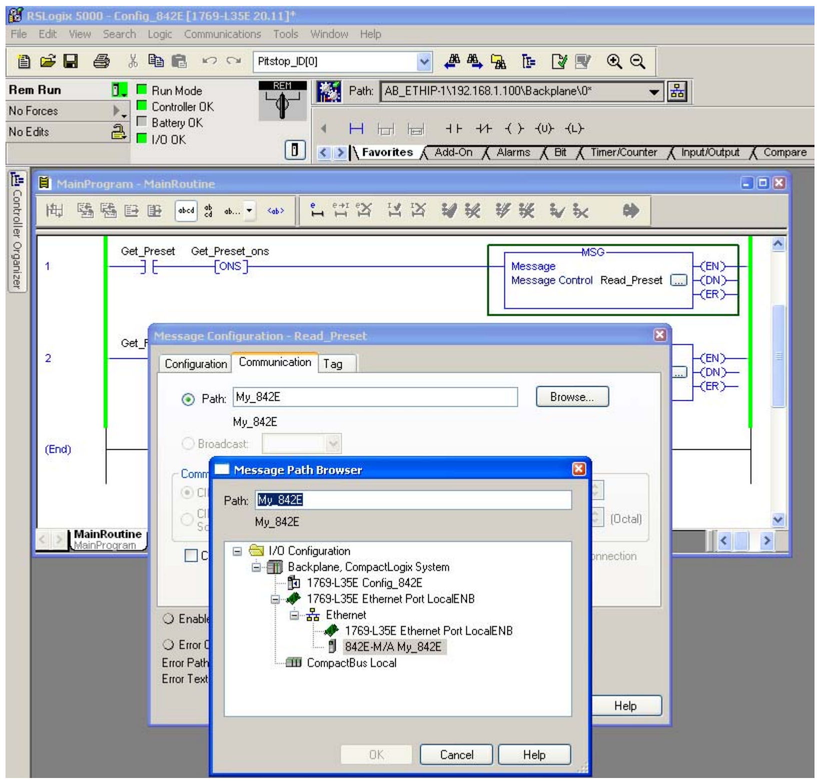
2. Add a new MSG instruction to the program and browse to the Read_Preset data type created in step 1. Then double-click the gray box on the message instruction to configure it.



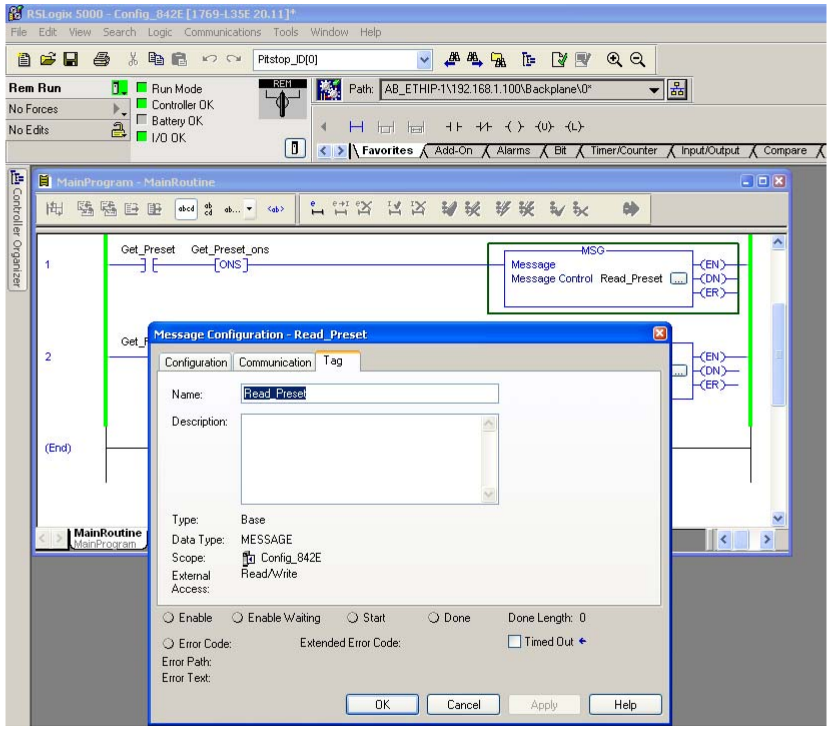
3. In the Configuration tab select:
   Message type: CIP generic
   Service type: Get attribute single
   Service code: (automatically populated)
   Source element: Preset_Value_Read (browse to this tag).
   Instance: 1
   Class: 23*
   Attribute: 13*

   * hexadecimal values

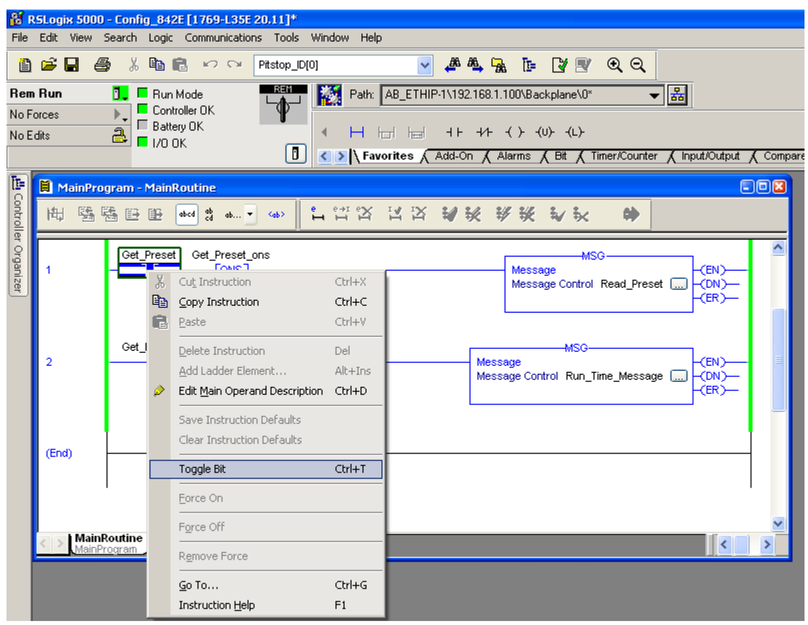
4. In the Communication tab, browse to the encoder on the ethernet network, then click OK.



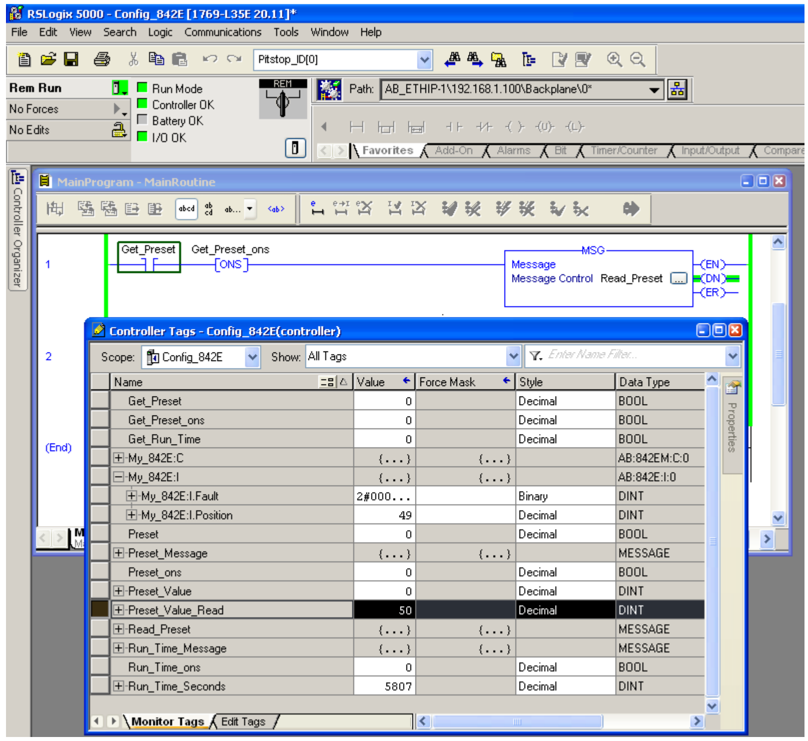
5. The Tag tab will be populated for the Read_Preset.



6. Add a normally open contact and a one-shot instruction to initialize the message instruction.



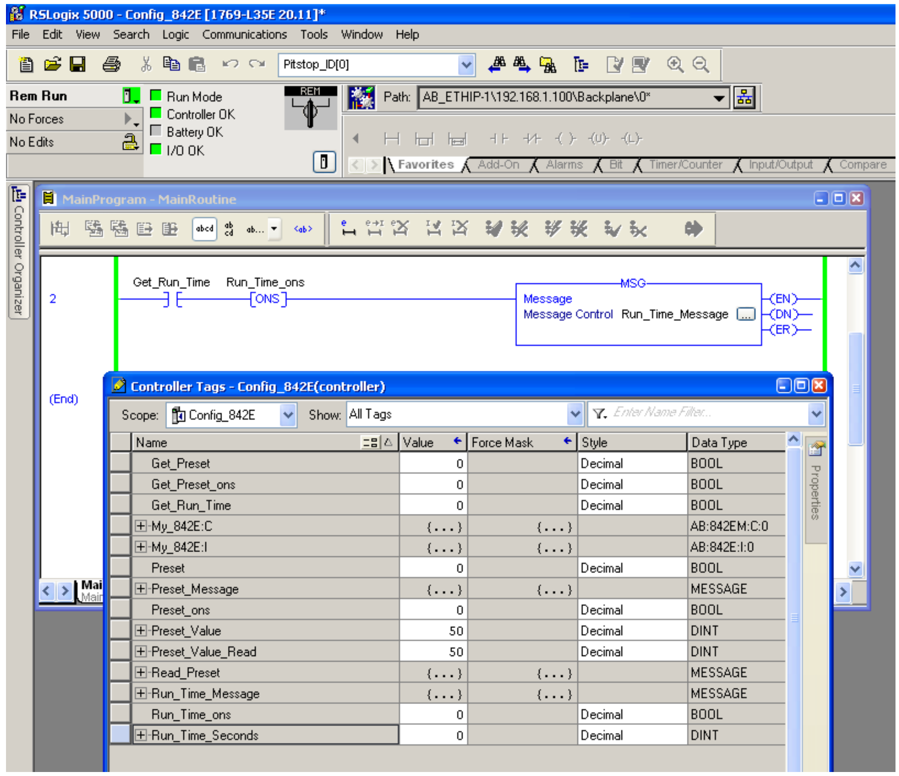
7. Toggle the Get_preset contact, the message instruction returns the preset value form the encoder into Preset_Value_Read DINT.



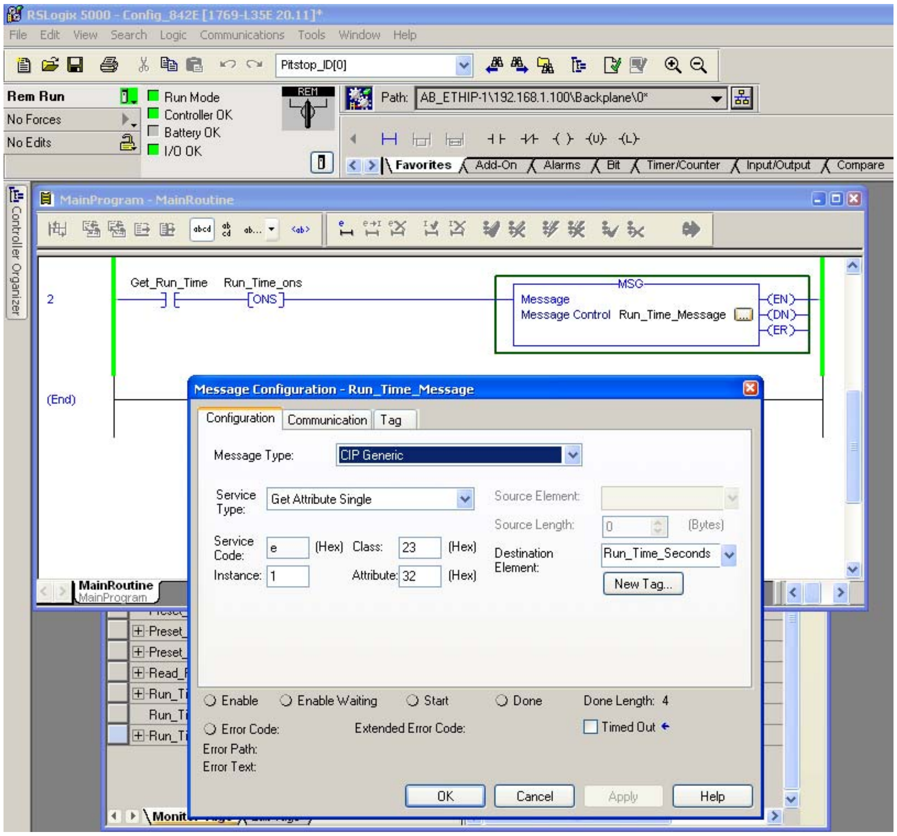
Using an explicit message configuration to obtain the encoder's run-time in seconds

This example is similar to the previous one, "Using an explicit message configuration to read preset encoder value" on page 69.

1. Create a new message data type named *Run_Time_Message* and a DINT named *Run_Time Seconds.*



2. Add a new MSG function block to the program, browse to the *Run_Time_Message* data type created in step 1. Then double-click the grey box to configure the message instruction.



3. In the **Configuration** tab select:

   Message type - CIP Generic

   Service Type - Get Attribute Single

   Service Code - (Automatically populated)

   Destination Element - Run_Time_Seconds (browse to this tag)

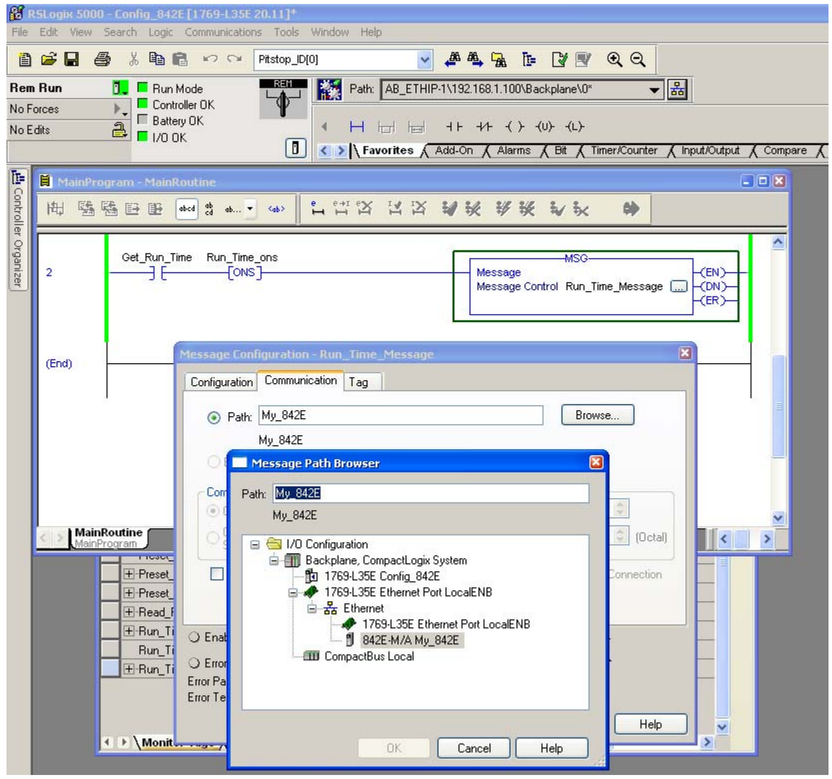
   Instance - 1

   Class - 23*

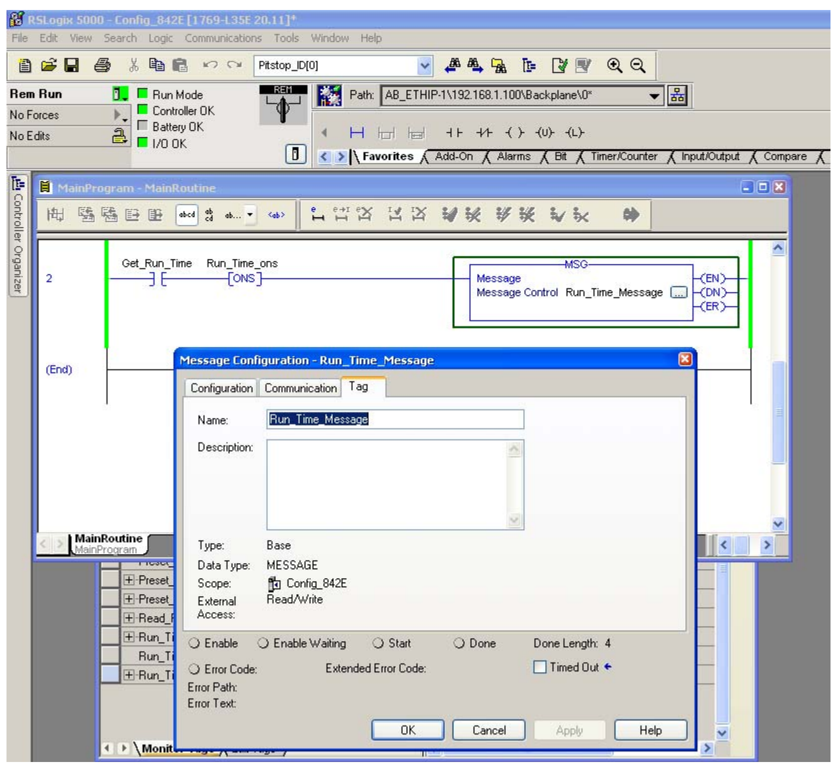
   Attribute 32*

   * hexadecimal values

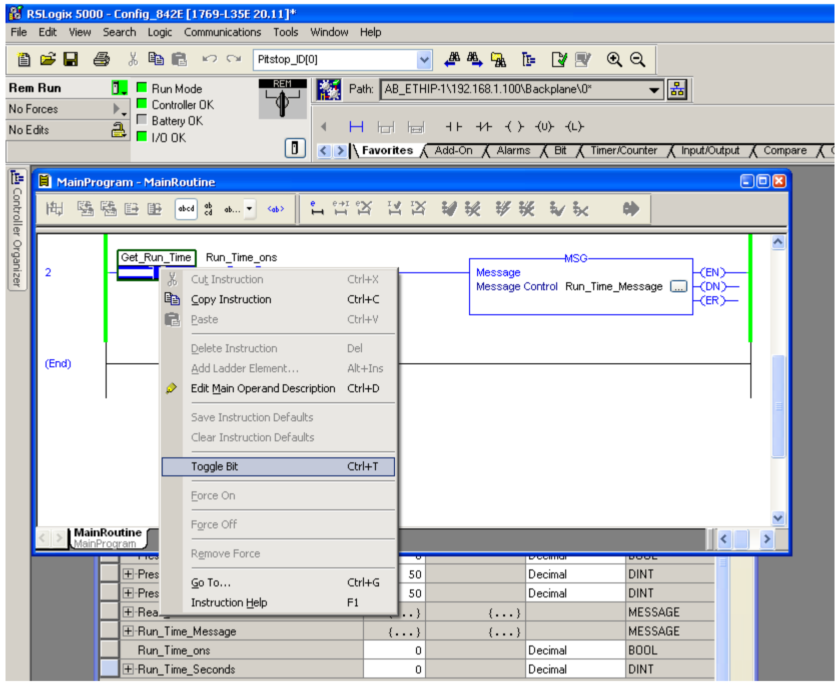
4. In the **Communication** tab, browse to the encoder on the ethernet network, then click **OK**.



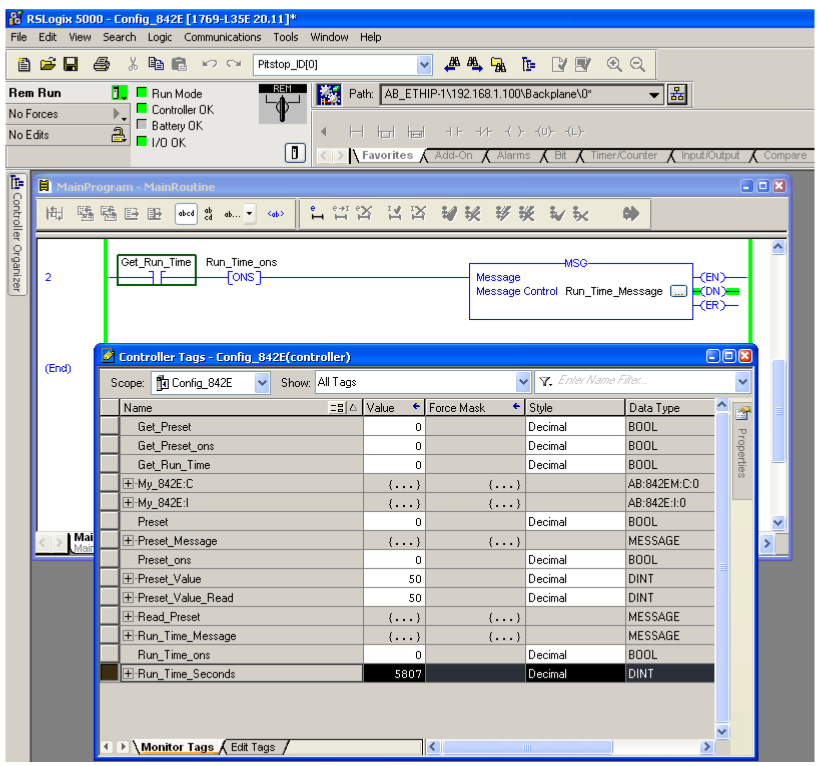
5. The **Tag** tab will be populated f or the **Run_Time_Message.**



6. Add a normally open contact and a one-shot instruction to initialize the message instruction.



Toggling the **Get_Run_Time** contact initiates the message instruction and returns the current run time in seconds into **Run_Time Seconds DINT**.



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